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Editor:
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,, *2—Carpenter Bird and Cacao.
,, 3—Courses of Reading and Examination in Practical Agriculture.
,, 4—Strongylus Parasites in Cattle.
,, *5—On Spraying Froghoppers.
,, *6—The Froghopper Fungus and its Practical Application.
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(ISSUED BY THE DEPARTMENT OF AGRICULTURE.)

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No. 1—Life History and Control of the Cacao Beetle.
,, 2—Report of the Mycologist for the year ending March 31, 1911. Part I, containing reports of the Entomologist, Assistant Entomologist and Secretary.
,, 3—Insect Notes for the year 1910-11. Miscellaneous notes.
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CACAO.

ADDRESS TO THE NAPARIMA AGRICULTURAL SOCIETY.

(Delivered at River Estate on October 30, 1915.)

BY PROFESSOR P. CARMODY,
Director of Agriculture.

PROFESSOR CARMODY, in the course of a very instructive and practical address, explained the value of the statistics given. One of the things introduced was the simple method of ascertaining the yield of cacao that could be obtained from an estate. They could now safely recommend to the small or large proprietor that 12 pods represented 1 lb of dried cacao. A small planter's success depended upon his knowing something about the yield of his cacao. Again, the number of pods could easily be translated into the number of bags per 1,000 trees for half the number of pods given by a tree would give the number of bags per thousand.

YIELD OF INDIVIDUAL TREES.

The first thing that they would notice in the experiments in Field 1 was this: that although they took plots which they considered to be equal as regarded yield, certainly as nearly equal as they could be as regarded soil, yet 50 trees in one plot were not equal to 50 trees in another plot. The result of their experiments was not by any means comparative in consequence and they found it was desirable to ascertain on a much larger scale what was the yielding capacity of trees on the estate, and at the present time they knew the individual yield of at least 10,000 trees on the estate. The individual yield of trees had been entirely overlooked in the past, and they should pay more attention to it in the future. Thirty-three pounds of dried cacao was the highest yield given by any one tree on the estate. Another point they had settled was that the tree which gave a heavy yield one year also gave a heavy yield in succeeding years.

MANURES.

With respect to manures, the speaker distinguished between three kinds: (1) mineral, (2) animal and (3) vegetable. Vegetable and animal manures might be put in the same class as organic manures, the latter being more concentrated. With regard to plants, it was found that about thirteen different substances were utilized by plants in their growth, but only three of these were regarded as having a commercial value as manures. The reason was this: that these three were in smaller quantities than the remainder and that unless they were there in minimum proportion, one did not get a satisfactory growth. Those three manures were classed under the heads: (1) nitrogen, (2) phosphates and (3) potash. Nitrogenous manure was more expensive than the others. But the supply of potash which came chiefly from German mines was limited at present and difficult to obtain. The most essential thing in the soil and the tree was rainfall, without which they could not grow cacao or anything else. Generally speaking, if the rainfall came in July better returns were obtained than if it came in August or September. The speaker then discussed the returns from the several manurial fields. The manures they had used, he continued, had been those most easily obtainable, such as pen manure, goat manure, bird manure, &c. These had been tried separately and in combination with mineral manures and the latter was more inexpensive and gave good results. As to lime, many planters have pinned their faith to it as a manure. But if there was not organic matter in the soil it was far better to leave lime out of the soil, because it did more harm than good. There was very little organic matter in Trinidad soils, and they would find that the lime plots were considerably below the others. As to mineral manures, the same remark was true as to lime. Mulch was spoken highly of by everybody and it was a very valuable way of adding organic matter to the soil. But their experience showed that it was the dearest manure if they had to carry it any distance. The yields which gave the most striking results this year were the bird manures. By combining pen manure and small quantities of mineral manures they got 21 bags per 1,000 trees in 1910, and 35 bags this year. The number of the trees which gave under 1 lb cacao was very large when they started the experiments, but it was getting less as they had gone on with manure; and he believed that the tree which did not give 2lb of cacao was hardly worth cultivating. In another field, after paying for manure (sulphate of potash and basic slag), valuing their cacao at 11c. per lb., they made a profit of $75 the acre. Pen manure gave more yield in cacao, but cost more and so made profits less.

CHUPONS.

With regard to chupons, a little while ago they published some figures which were misunderstood, and now they were going to publish the result of five years' counting on the chupon experiments. These experiments were started with two sets of trees,—one when the trees were 9 or 10 years, and the other, 25 to 30 years, In the younger trees, one chupon gave the best results.—61,875 pods; no chupons, the next best,—61,663, two and three chupons,—57,000 and 55,000 and the worst results from the all chupon,—43,000 pods. When they came to the old trees, they found this difference; the best results were got from no chupons—the next best from all chupons—65,000 and 62,000 respectively; three and one chupons,—57,000 and 56,000 and the worst, two chupons; 48,000. The speaker came to the conclusion that it did not really make much difference whether they had or had not chupons. All these results were influenced a great deal more by the individual yield of the trees than by anything else.

SHADE.

With reference to shade, there were three experiment plots: (1) shade, (2) no shade and (3) partial shade. The trees in the "no shade" plots were damaged by the cutting down of the immortels, but they derived some benefit from mulching. The trees with partial shade were not so much damaged, and also got benefit from mulching. In four years, the partial shade trees gave the highest results,—51,000 pods; no shade,—49,000; full shade,—44,000. Those results were also to a certain extent influenced by the individual yield of trees. In the experiments with the young trees, the total yield for four years under the experiments, gave 29,000 pods with full shade and 17,000 with no shade. This was explained by the fact that the full shade trees were older and larger than the no shade, and the no shade trees had been kept back from fruiting by allowing the branches to grow freely to prevent the soil being sun-burnt.

The party then broke up into two sections, and under the respective leadership of Professor Carmody and Mr. J. C. Augustus were taken through the manurial experiment fields.

RIVER.

Sir Norman Lamont, Chairman of the Naparima Society, in seconding the vote of thanks proposed by Mr. Tripp, Secretary of the Parent Society, said two things particularly claimed their attention at River Estate; (1) the thoroughly practical work that was being carried out and (2) the thoroughly practical objects to which all their experiments were directed.

One had often heard the criticisms that the Department was of very little use to planters and that it was theoretical in its work. But those who said so (1) either had not seen, (2) or had seen without understanding or (3) were not practical men themselves (laughter and cheers). The statistical work done by the Director and his staff in connection with the experiments was simply amazing and was worthy of a big statistical department. He assured Professor Carmody of a warm welcome when next he came to San Fernando.

Professor Carmody, in reply, thanked both Mr. Tripp and Sir Norman Lamont for their appreciation. He regretted that time prevented them visiting the chupon fields. Perhaps they would be interested to hear that the estate formerly belonged to the Lamont family (loud cheers). In the chupon fields there were to be seen the race course and the ruins of the family residence.

Port-of-Spain Gazette (Revised report).

PESTS IN GRENADA.

Having investigated cacao pests in Grenada in March 1915, M. H. A. Ballou, the Entomologist of the Imperial Department of Agriculture has made a report of which the following is a summary:

THRIPS.

Thrips is permanently present and generally distributed in Grenada. It occurs year after year in the same localities, the same portions of cacao field, and perhaps upon the same trees. These patches are always suffering from some more serious trouble than thrips and in fact it is suggested that thrips should now be regarded as an indicator of root disease, bad drainage or unfavourable soil conditions, rather than as a primary pest.(1)

CACAO BEETLE.

The cacao beetle is a well known pest which is causing some damage and for the control of which certain estates are spending a fair amount of money. Better methods of pruning and caring for trees will probably help in reducing the amount of injury from this pest. Extended use of traps and possibly spraying with lead arsenate may be found of value.

ACROBAT ANT.

The acrobat ant is now referred to for the first time as a cacao pest. Its attacks are encouraged by bad pruning and careless treatment of borer wounds and all decayed places in cacao trees. Experiments should be made with a view to finding some better wound dressing than any now in use.(2)

BLACK BLIGHT.

Black Blight in itself does very little damage, it is generally a result of the presence of an abundance of certain kinds of scale insects. It is essential that these scales be recognised and the amount of damage done by them determined in order that it may be decided how much may be spent in its control. The use of the term "black blight" in Grenada is an unfortunate one. Constant reference to "black blight" directs attention away from the habits of always considering scale insects by distinctive names which would greatly help in establishing in the minds of all a proper basis for the consideration of the problem. Black Blight at present does not occur on cacao to any extent. Sometimes shade and other trees become infested with insects which encourage black blight and this communicated to the cacao trees; mealy bug which occurs to a small extent on cacao is also accompanied by the black fungus. There seems to be no danger that any of those insects now known to occur in Grenada which are accompanied by black blight will eventually become pests of cacao.

SCALE INSECTS.

Scale insects are controlled to a certain extent by natural enemies both fungoid and insect. These may be encouraged but care must be taken not to destroy them in attempting to control the scales, thus perhaps doing more harm than good.

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(1) Our experience in Trinidad is quite different. Thrips occur independently of disease or bad conditions of soil. In some cases Thrips have yielded to thorough liming and drainage of fields, but they have been known to return to the same fields a year or two after. The prevalence of Thrips in sufficient numbers to cause damage depends primarily on Shade or No Shade and on the weather; dry seasons being more favourable to development. (F. W. U.)

(2.) In Trinidad the Acrobat Ant (*Cremastogaster brevispinosa*) is rarely found on Cacao trees but occurs mostly on guava and orange. (F. W. U.)

THE SURINAME WITCH-BROOM DISEASE OF CACAO.

An interesting bulletin (¹) has recently been issued by the Suriname Department of Agriculture. It gives the results of the investigation of the witch-broom disease carried out by Stahel during the past eighteen months. As this disease has caused so much loss to the cacao industry in Suriname and as there is always the danger of it being introduced into Trinidad, because of the proximity of the two countries and the extensive travel between them, an advance in the knowledge of the disease is of great value to the Trinidad cacao planters.

At the outset of the work in order to get pure cultures of the causative fungus, Stahel followed much the same method as that used by the reviewer.(²) The results were practically the same. From one hundred and eighty-six cultures made, one hundred and seventy-five gave pure cultures of the same fungus, the mycelium of which showed clamp-connections, thus indicating the causative fungus belonged to the Basidiomycetes or Mushroom-like fungi. No fruiting bodies were obtained in cultures. However during the rainy season, three different types of mushrooms were found on dead witch-brooms. One of these was a species of Marasmius, and as this is a genus to which several parasitic fungi belong, Dr. Stahel selected it for inoculation purposes.

Spores from mature fruit bodies were placed on unopened buds and the plants were kept moist. From fifty buds treated in this way fourteen typical witch-brooms developed. A second series gave seven witch-brooms from nine buds treated, while a third gave nine witch-brooms from ten inoculated buds.

These experiments show clearly that the disease is caused by this species of Marasmius to which Stahel has given the name *Marasmius perniciosus*. In the long rainy season the fruiting bodies of the fungus can be found on at least 50 per cent. of the dead witch-brooms. Sometimes there are but 2 to 3 fruit bodies on a witch-broom, but often there are as many as twenty or more. They are in the form of small mushrooms about ¼ to ½ inch or at most one inch across the cap. The surface of the cap is faintly crimson tinted, but in the centre is a dark red spot surrounded by smaller spots of the same colour.

In nature, the spores, which are borne in enormous quantities on the gills of the mushroom, are blown by the wind or carried by rain or insects to healthy buds, which become infected, and develop the witch-brooms.

Stahel is lead to believe that the hardened pods are caused by the same fungus, but has not yet been able to produce them by inoculation with spores from the Marasmius.

A full discussion of remedial measures is given, and Stahel recommends as the most rational method of treatment, the cutting off and removal from the field of all witch-brooms and thorough spraying with Bordeaux mixture.

J. B. R.

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(1) Stahel, G. "*Marasmius perniciosus* nov. spec. the cause of the Krulloten (Witch-broom) disease of cacao." *Bull, 33, Department van der Landbouw in Suriname.* Sept. 1915. In Dutch, English and German.

(2) Rorer, J. B. "The Suriname Witch-broom disease of cacao." *Circular 10, Board of Agriculture, Trinidad and Tobago* July 20, 1913.

GOLD COAST CACAO.

The Gold Coast exported cacao to a larger amount than Trinidad during the following years:

	lb.	value.
1911	88,987.324	£1,613,468
1912	86,568,481	1,642,733
1913	113,239,980	2,489,218
1914	118,469,120	2,193,749

The declared value for 1914 is at the rate of 2·4 pence per lb.

The Department of Agriculture is paying attention to the yield of individual trees, and to the number of pods required to give 1 lb. of dry cacao. The figures obtained are interesting for comparison with ours:

Station.	Variety of Cacao.	No. of pods to 1 lb. cured cacao.	
		1913.	1914.
Aburi	Amelonado	13·1	14·5
do.	Cundeamor	11·1	12·
do.	Ocumare	...	15·1
Tarquah	Amelonado	...	13·1
Coomasie	Mixed	11·16	12·75
Assuantsi	Mixed	12·3	14·7

The Amelonado variety at Aburi gave an average yield from three plots of 122·5 pods per tree which is 7·5 less than the previous year; the average yield of cured cacao was 8·44 lb. compared with 10·27 lb. in 1913 shewing that the pods obtained were of much smaller size.

One tree gave as many as 345 pods between May and December, equal to over 23½ lb. of cured cacao.

Early maturity of the trees at the Gold Coast is remarkable. Trees planted in the latter part of 1912 began to bear in 1914, and the Director adds in his report "that there is every appearance of a fair crop during next year" (1915.)

The rainfall at the station (Kibbi) where this result has been obtained amounted to 68 inches in 1914 and 79 inches in 1913.

LIMES.

NOTES ON THE LIME AND THE LEMON.(1)

THE yield per acre of an established lime plantation varies considerably, but a good average is 150 barrels of fruit. The weight of a barrel (4½ cubic feet) of limes is about 160 lb. Hence an acre of good land may be regarded as yielding 24,000 lb. of fruit.

PRODUCTION OF LIME PRODUCTS IN THE WEST INDIES.

RAW LIME JUICE.

The greater portion of the crop is disposed of as concentrated and raw lime juice. A barrel of limes gives about 7½ gallons of juice. There is generally a considerable loss, owing to the imperfect working of the mill, which may reach 2 gallons of juice per barrel. Fresh lime juice contains 12½ to 14 ounces of citric acid per gallon. In preparing the lime juice the strictest attention must be paid to cleanliness and to proper straining.

CONCENTRATED LIME JUICE.

In order to reduce freight charges lime juice is generally concentrated to contain 100 oz. of citric acid per gallon, but the degree varies according to market prices. During the process of concentration there is an unavoidable loss of acid due to burning. In the case of open tayche concentration, such as is generally employed at present, this amounts to over 10 per cent.; but with the steam coil vat the loss is nearer 2 per cent.

CITRATE OF LIME.

Under certain circumstances, it is found advisable to dispose of the lime juice as calcium citrate or citrate of lime. Its preparation is simple. The raw juice is run into a vat and heated to boiling point, and is then neutralised with pure slaked lime. The disadvantages attendant on making this product on a small scale are the washing and drying arrangements which are necessary.

It is generally accepted that 76 barrels of fruit are required to make 6 cwts. of citrate of lime, or 1 gallon of juice is equivalent to 1·18 lb. of citrate of lime.

ESSENTIAL OILS.

Before the fruit is crushed with a view to manufacturing the above products it is usually "écuelled" or hand-pressed to extract the essential oil in the skin. The quantity of oil obtained by this method of pressing the fruit over a spiked surface varies with the skill of the worker, but in practice 1¾ to 2 oz. per barrel of fruit may be taken as an average figure, though the yield is often considerably higher.

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(1) This paper is a reproduction *in extenso* of the chief matters dealt with in an interesting article entitled "Notes on the Lime and the Lemon as sources of Citric Acid and Essential Oils" by W. R. Dunlop, Scientific Assistant to the Imperial Department of Agriculture for the West Indies, which appeared in the *Bulletin of the Imperial Institute*, xiii. 1915, 66–87.

Distilled oil of limes is an entirely different substance. This oil is distilled from the juice during concentration, and although the yield is higher than in the case of the hand-pressed product, being 4 lb. for every 100 gallons of juice, its market price is much less than that of "hand-pressed" oil.

"Hand-pressed" oil usually fetches from 5 shillings to 6 shillings per lb.; distilled from 1s. 2d. to 1s. 6d. per lb.

FRESH LIMES.

During the last ten years a very considerable trade in fresh limes has developed between Dominica and New York. Latterly St. Lucia and other West Indian Colonies have participated in this trade. Great care must be exercised in the matter of preparing the fruit for export. The green fruit must be kept in a packing house for a few days previous to being shipped in order to allow the fruit to quail—that is, lose excess of moisture in the skins. The fruit must be carefully graded, wrapped in paper, and packed in ventilated barrels. Careful handling in all operations is an essential feature.

Whether in the future, as the area under limes grows larger, the fresh fruit trade will increase greatly, is difficult to foresee. In the United States the lime appears to be replacing the lemon for certain purposes. In the case of the United Kingdom the trade has never assumed any great importance for several reasons. In the first place, the voyage to England is nearly twice as long as to New York, which puts difficulties in the way of transporting perishable produce. Secondly, the British taste is conservative. The public is familiar with the lemon, and it is not generally inclined to discard it in favour of the lime, even if this fruit were regularly available. As a matter of fact, the fresh lime can only be available in any quantity during the latter half of the year, whilst the lemon is always to be had. Furthermore, the fresh lime is essentially an article for immediate sale. It does not keep as well as the lemon, and the retail salesmen do not view it with favour from a business point of view. In New York the consumption during the hot months is rapid and continuous; the fruit can therefore be bought with a certainty of profitable sale.

Of course the peculiar feature of the fresh lime trade is its elasticity or accommodating nature. If prices range beyond a certain point it pays to ship; if they do not, the fruit can be held back for manufacturing purposes. The trade with New York is run on this principle, and it is worthy of note that growers are not absolutely dependent on this outlet for their produce.

In the case of the United Kingdom it would seem for the present quite unnecessary to go to any expense with a view to pushing the fresh lime trade, as it is likely that more profit is to be made there out of concentrated juice and the essential oils—two products which do not really now come into direct competition with Sicily because that country produces citrate and essential oils which have special uses.

Nevertheless, if a demand for limes could be created they would both chemically and dietetically withstand competition with the lemon.

LEMON AND LIME YIELDS AND PROFITS CONTRASTED.

The writer has prepared the following table to show the relative yield in lemon and lime cultivations.

	Lemons *lb. per acre.*	*Limes* *lb. per acre.*
Yield of fruit	27,460	24,000
Yield of juice	10,560	11,550
Containing		
Citric Acid... ...	634	914
Oils	88	65 {19 46

These figures indicate that the yield of fruit per acre in the case of lemons is greater than the yield of limes, taking four lemons to the pound; but the yield of juice and citric acid is considerably less. The amount of oils yielded, however, is greater in the case of the lemon.

It seems that the figure "275,000 lemons per hectare" can be accepted as being representative of the average lemon grove. The English equivalent for the above figure is 110,000 fruits per acre, and if there are 190 trees per acre, this gives a yield per tree of about 580 lemons, which corresponds with the average given by the American authorities (*Bulletin* 190, *Bureau of Plant Industry U. S. Department Agriculture*) and is well below the yields of the best lemon plantations.

When one comes to consider profits, it has to be remembered that the cost of handling the lemon crop is much greater than in the case of the lime crop. There are also expenses in connection with irrigation, frost protection, and manuring, and the rental value of good lemon land is higher than that suited to lime cultivation. On the other hand lime cultivation has heavy shipping freights, though, as a matter of fact, these cannot on the whole work out much higher than those for lemons and lemon products, considering that Italy sends about half of its crop to the United States.

From the producer's point of view it is clear that the lime can easily compete with the lemon as a source of citric acid. In considering the figures given for lime cultivation, it should be borne in mind that these two are based on conservative estimates and the annual losses are allowed for, which in all probability will be greatly reduced in the near future, as improved methods of preparation are more widely adopted.

Prices are likely to drop immediately in the future. For one thing, the war will interfere with the consumption of fresh lemons, and Sicily will probably make more citrate and oil. Lime cultivators will have to make every effort to improve their yields, which can be done, and to ship concentrated juice, only good quality raw juice, and essential oils. With greater production per acre lime growers can stand a lower market value than the Sicilian growers. Moreover, the West Indies are nearer New York and Canada. Lime cultivation has the advantage over lemon growing in Sicily in this respect also.

SELLING BASIS OF LIME JUICE AND OILS.

Concentrated lime juice is sold on the basis of its citric acid content. The juice is quoted on the basis of a standard "pipe" of 108 gallons, containing 64 oz. of acid per gallon. A pipe is therefore equivalent to 6,912 oz., or 432 lb., of citric acid.

A West Indian hogshead of concentrated juice (100 oz. per gallon) contains about 52 gallons, and is equivalent to three-fourths of a standard pipe. A pipe contains 432 lb. of citric acid; a West Indian hogshead 325 lb. In commercial analyses the citric acid is mentioned as crystallised acid, containing only half a molecule of water instead of one molecule, as would be done in the case of ordinary analysis.

GROSS AND NET VALUES.

Some idea of the net amount realised from the sale of concentrated lime juice can be obtained from the following figures. The expenses are partly fixed and partly based on value.

If the sale price per pipe is £21 the fixed charges (labour, freight, packing etc.) amount to about £2 8s. 3d., and the charges (commission, brokerage, insurance, testing), based on value, come to about £1 0s. 6d. (=6½ per cent.) on a hogshead (52 gallons). The amount realised for this hogshead gross is £15 16s., hence the net value would be £12 7s. 3d. In the case of essential oils the charges based on value are higher (7½ per cent.)

NET VALUE PER ACRE.

Owing to the variation in local conditions, it is not possible to give reliable figures as to the profits made in the case of lemon and lime cultivations but, based on the values and charges noted above, the net value of lime juice and oil from an acre would be about £35. This does not allow for expenses of production previous to the preparation of the products and their shipment and sale.

According to a French estimate the clear profit in connection with lemon cultivation is about £45 per acre but apparently this figure does not allow for the cost of marketing. An American authority states that the profit in Italy on 100 lb. of oil and a pipe of citrate of lime is about $60 or £12 10s. Satisfactory information on the subject of profits can only be got through access to the accounts of an estate run on commercial lines.

THE MARKETING OF CITRUS PRODUCTS.

METHODS OF SELLING IN SICILY.

An important feature of the Sicilian industry which distinguishes it from the West Indian is the existence of a Camera Agrumaria or Citrus Chamber which is a Government Department for regulating market prices. The quotations which are made in London and in other markets by sellers are to a great extent based on the prices quoted by the Italian Citrus Chamber so that from the West Indian point of view it is an organisation of considerable interest. As a matter of fact, it may be laid down generally that the amount of organisation employed in the disposal of Sicilian citrus products is very great—far greater than in the West Indies, where there exists no central body which can regulate the output in anyway. In Sicily the proprietors generally sell their crops by contract before they are gathered, but have to fix a certain latest date for delivery. The sales are effected through immediate brokers called "country brokers." Occasionally the crop is sold by the thousand at each picking. The buyer usually picks the fruit when it is sold by the season. The grower usually picks it when sold at each picking. Practically none of the fruit is exported by the grower except occasionally in the case of experienced large producers. As already intimated the grower usually sells his fruit through a broker to the exporter or the manufacturer of by-products. The broker acts as an agent for both parties in the final settlement of the transaction, often shipping the fruit for the grower, receiving the money and depositing it or using it in purchases for the grower.

The citrate of lime and concentrated lemon juice are handled exclusively by the Camera Agrumaria, which fixes the prices periodically and allots monthly deliveries to the various buyers all over the world through their (the buyers') agents. The lemon oil however is extracted by other houses, who each have a distinctive *brand* for their oil and an agent in the principal markets for the sale of it. It will be seen from this that the Sicilian citrus trade lacks the competition among buyers which is enjoyed by the West Indian trade, and obtained by the methods referred to below.

West Indian Methods.

In the case of the West Indies each producer in the ordinary way, ships his own produce; but he may sell the fruit to one of the larger factories. In one instance a Government Factory buys fruit or raw juice from the small growers paying down so much cash and issuing a further amount in the form of a bonus at the end of the year, based upon the actual selling price of the manufactured products. Whatever the local method of disposal, the products are ultimately shipped to merchants at one or other of the principal markets. It should be mentioned here that a system of forward contracts is now being extensively adopted in the West Indies. This should be distinguished from the Sicilian method of crop disposal already described. The West Indian forward contracts refer to the shipment of juices, citrate of lime, and oils within a definite period at a fixed price. This forward business could be vastly improved, to the mutual advantage of buyer and shipper, if the latter would contract to ship a certain specified quantity each month of the contract period and also to maintain a uniform strength.

Citrus Products on the London Market.

The methods employed in handling West Indian citrus products on the London market are very different from those employed in disposing of the Sicilian products as will be seen from the following account.

As soon as a West Indian steamer arrives, the total available supplies of concentrated juice and citrate are communicated to the various buyers by the brokers who invite best offers for the whole or part. The highest bid received by the brokers is then made to the various merchants who are interested, and they decide whether it is to be accepted or not. It is rarely refused for it is recognised generally amongst the merchants that in this manner the highest price obtainable is secured as there is always a demand for citric acid materials and the buyer who needs it most, naturally bids his utmost knowing that he is in competition. The raw juice and oils however are treated rather differently for whereas the concentrated juice and citrate are always in demand, and are more or less necessities, the raw juice and oils are comparatively luxuries, and generally in more than sufficient quantities to meet the demand, which is spasmodic. Therefore the sale of these products is a slower business, and requires sometimes a great deal of negotiation.

The samples of the different shipments are exhibited at the broker's sale room where buyers and sellers are continually being interviewed, and in addition to this the most likely buyers are notified of any fresh arrivals. Samples of these products are also posted to buyers resident in the country or abroad.

The brokers keep themselves advised on all matters likely to affect the prices and when sales are effected shippers may rest assured that the price arranged has been fixed after due consideration by the merchants of all the circumstances controlling the market.

It will be noticed here that the system of sales adopted in the case of citrus produce differs from that employed in the case of cacao or sugar or rubber. In these there is an open sale—an auction; in the case of citrus the produce is sold by private treaty.

It may be questioned whether this system of conducting private sales is in the best interest of the growers. There seems no doubt but that it is quite as satisfactory, for users will often give higher prices privately than they will in public; and moreover the broker is better able to find the best buyers since he is in touch with their individual requirements.

DEFECTS IN WEST INDIAN PRODUCTS.

It would seem that the importers of West Indian citrus products have, as regards production, several comments to make that seem quite justified. The quality of the citrate of lime from the West Indies is regarded as highly satisfactory and there is no need to refer at further length to this product. As regards raw lime juice it would seem that there is a tendency to ship inferior grades. Heavy arrivals of lower qualities obviously depress the market whereas the better produce would be likely to maintain high prices. In some shipments the casks are not clean and very often the percentage of pulp in the juice is undesirably high. It is strongly urged in London that to maintain a steady trade in raw lime juice at remunerative rates, these inferior qualities should not be sent at all.

The shippers would ultimately reap the benefit by the better prices obtained for their smaller output, for there really exists a need for a good Dominica juice of uniform quality. It should be of bright greenish tint with a small percentage of pulp (floating preferred). It should not be contaminated with iron, and should contain the average percentage of acid. Juice of low test or bad colour is absolutely neglected by buyers while anything else is available and it does not improve on keeping. Raw juice imported from Jamaica very frequently sells at good prices. This is believed to be the result of not extracting the oil which preserves the juice.

In endeavouring to obtain information concerning the marketing of concentrated juice the writer was enabled, through the courtesy of Messrs. Ogston & Moore, to compare samples of lemon and lime juice. Generally speaking it would seem that the Sicilian concentrated juice, such as there is, arrives in a much brighter condition than the West Indian product. Another important point is that Sicilian lemon juice (concentrated) is always of about the same test, whereas the West Indian varies from 50 oz to 140 oz. making it very difficult for buyers to know what they are getting. It is also worth noting that the calico dyers in Manchester state that West Indian concentrated juice often contains more sediment than is desirable. Because concentrated lemon juice arrives in a more fluid state than lime juice its employment in the textile trade is facilitated; and what is equally important to the grower, this condition of the lemon juice makes sampling easier. Messrs. Ogston & Moore state that the variation in the acid content of samples from the same cask of concentrated lime juice is largely due to the viscous nature of the fluid. In connection with sampling and testing there are many difficulties, as is well known to both buyers and growers. It must be borne in mind however that the fluctuations work both ways: sometimes an analytical result may favour the grower; at other times the buyer. It is well to mention here that samples of imported citrus products are generally taken at the wharves as soon as the ship is unloaded. In some instances samples go direct, but this is the exception, as the broker is supposed to examine a sample from each shipment and report upon it where necessary. Brokers make themselves familiar with samples in order that they may recommend certain marks for special purposes. The samples are analysed in duplicate and are kept for future reference.

CITRUS OILS.

In concluding this section, a few words may be said concerning the market characters of citrus oils. Citrus oils should be packed only in the best tins and on no account should distilled oil be mixed with hand pressed (écuelled). The writer was shown in Mincing Lane samples of oil which were undoubtedly spoilt in this manner. It should be remembered, in considering Sicilian competition that the West Indian lime oils are used in the toilet and confectionery trades for different purposes from the lemon oils. Hence whatever the Sicilian production—which cannot increase largely if the fresh fruit trade holds—there will always be a special demand for lime oils from the West Indies, provided that they are of good and uniform quality. In this business too the Sicilians have been longer in the field and their lemon oils are prepared with the greatest care resulting in a uniform article, so that buyers know they can rely upon always getting the same quality. Hand pressed lime oil on the other hand varies tremendously even from the same estate and it would be a wise step for a planter to bulk, say, two or three months' product of hand-pressed oil (keeping out any of bad colour) and shipping only two or three times during the season. This would give him a regular quality and his mark would gradually become known on the London market and preference would be given to it by buyers who want an article on which they can rely.

SUMMARY OF CONCLUSIONS.

1. The output of lime products in the tropics, although comparatively small, is rapidly increasing. The Sicilian production of lemons, is on the other hand, stationary, but according to the demand of the world's market, this country can increase her output of citrate at the expense of fresh lemons, and *vice versa.* Lime growers can to a certain extent do the same, but are less able to exert influence in this respect.

2. An examination of figures relating to the composition of the lemon and lime shows that the lime is richer in juice and citric acid than the lemon. But the lemon generally contains more essential oil.

3. As regards cultivation, the two crops differ in many respects. Lemon cultivation seems the more expensive owing to the necessity for irrigation, frost protection, and handling, but lemon products can be placed on the European market at less expense than lime products.

4. For purposes of comparison the lemon may be regarded as yielding 634 lb. of citric acid per acre against 914 lb. in the case of limes. The figures for essential oils are 88 lb. and 65 lb. respectively.

5. In view of the probable increase in the Sicilian output of citrate, lime growers might with advantage increase their shipments of concentrated juice of uniform density (about 100 oz. of citric acid per gallon). Only raw lime juice of the best quality should be shipped. Since lime oils are used for different purposes from lemon oils, they cannot be said to come into direct competition unless the qualities of one are so inferior as to permit of the substitution of one by the other. Oils take longer to sell than other citrus products. Lime oils are on the whole more variable than lemon oils.

6. It is not possible on the basis of available information to compare the profits from lemon and lime cultivation. With good prices it is probable that it is greater in the case of limes.

7. As regards marketing the existence of the Sicilian Camera means lack of that competition amongst buyers which is enjoyed by the lime-growing industry. At the same time the Camera ensures a minimum price for lemon growers.

8. The testing of samples is not as satisfactory as it might be. This is said to be largely the result of variation in the composition of juices in individual shipments.

9. A profitable trade in orange oils might be more generally established in the West Indies.

The writer is indebted to the Director and Staff of the Imperial Institute, where these notes were prepared, for providing facilities and for much valuable assistance in other ways. Acknowledgments are also due to the West India Committee. To Messrs. Lewis and Peat, 6, Mincing Lane, E.C., the writer is indebted for most of the observations on the marketing of citrus products. Thanks are due to Messrs. Ogston & Moore, Analytical Chemists, for their views connected with the same subject.

PLANT DISEASES AND PESTS.

NOTES ON THE SOUTH AMERICAN LOCUSTS.

Schistocerca paranensis, *Burm.*

BY F. W. URICH,
Entomologist, Board of Agriculture.

IN the last number of this *Bulletin* (XIV, p. 197) it was mentioned that flying locusts had made their appearance in Venezuela in September and October, and might possibly arrive in Trinidad. Although Trinidad proper was not invaded by any swarms, a small one alighted on the island of Patos on November 3. When the island was visited on November 5, it was found that the swarm had located itself on the highest point near the flag staff (in the centre of the island) and was feeding sparingly on the wild vegetation, although large numbers of the insects had settled on the branches of the shrubs and trees in the vicinity. They appeared as if at rest after their flight. Some bare spots on the south of the island were also invaded.

FIELD EXPERIMENT WITH BRAN MASH.

Bran mash in accordance with Hunter and Claasen's formula was prepared and varied slightly by leaving out the oranges or limes. Before being put out, the land around the flag staff was cleared of undergrowth to the extent of about an acre; the mash was scattered broadcast at the rate of eight pounds to the acre. The bare spot on the south of the island was similarly treated. As soon as the sun was out, the insects started eating the mash. The day after the first application, dead and dying insects were plentiful on the ground and after three days there were hardly any insects left. An unexpected result of the bran mash was the poisoning of numerous rats which infest the island. The rats were poisoned either from eating the mash or the dead locusts, or from both. As many as thirty dead rats were counted on one spot and there is a distinct odour of decomposing rats on the island now.

REPORTS OF MOVEMENTS OF THE SWARMS ON THE MAINLAND OF VENEZUELA.*

Since September fliers appear to have been moving about in the Gulf States of Venezuela. Swarms maturing in the middle of September at Guiria headed in a westerly and northerly direction. On October 29 Mr. W. S. Kernahan reported that large swarms arrived at Guiria coming from Yaguaraparo and Yrapa, the direction of flight being from south to north. The swarms are reported to be larger than those of June. On November 4 locusts were still flying in from the west. The swarm which invaded Patos on November 3 apparently came from Cariaquito. The coast of Venezuela from Guiria to Yagua is said to be infested also.

Mr. D. C. Plummer reports that great quantities of locusts arrived at Patao from the north and east in November. He says:—"They alighted in great quantities on the coconuts, some of the branches of the palms breaking from their great weight. Large quantities were also observed on the ground and on the plantains, etc. In the afternoon they travelled from the north, circling to the south of the bay and alighting on the east of the estate in a large savannah where they evidently slept during the night. Every morning they were observed travelling from the east, again circling the bay, making their way to north of the estate. Walking through the estate, I particularly observed that they were not to be seen in dark shady spots, but in open sunny spots they were observed in great quantities. On the Thursday following, just one week after their appearance, I observed very few on the trees, but they were thick on the ground, so thick that it was with difficulty that one could walk about. I then observed that they were all in pairs, evidently copulating. This continued until the Sunday (on Saturday we had heavy rains) when they left the estate, travelling east; after that only a few were observed here and there. From this observation, it is evident that they left their eggs behind and that another swarm will hatch at some future date."

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* See Map published in *Bulletin* XIV, p. 128

DAMAGE TO CULTIVATION BY THE PRESENT SWARM.

Mr. Kernahan writing from Guiria reports that not only is damage done to corn and banana cultivation but also to ground provisions, coconuts to no small extent; anauca immortels have been stripped of their leaves. On this occasion cacao flowers and young pods had been eaten when other food was wanting. Orange trees were also attacked. The locusts also attacked cacao beans in the process of drying.

Mr. D. C. Plummer, from Patao, says that roughly about 5 per cent. of the coconut palms were totally stripped and about 10 per cent. partially. All sucrier bananas were completely destroyed, silk bananas only slightly. All immortels were completely defoliated. Cassava, corn, and cane were eaten to the ground. Cacao trees were not touched.

PRESENT SITUATION.

Under date of November 26 Mr. Kernahan writes that hoppers had started hatching in large numbers near Guiria. Eggs received from Guiria from the British Vice-Consul, Chevalier E. G. Pernuy on November 11, hatched in the Laboratory, between December 1 and 8. There are rumours that in the interior of Venezuela there are still a great many fliers, but it is reasonable to expect that by now oviposition is completed and that the adults are disappearing. As far as can be judged, the danger of an invasion of Trinidad is over until February.

December 11, 1915.

BRAN MASH AS A RAT POISON.

By F. W. Urich,
Entomologist, Board of Agriculture.

In connection with the field experiments with locusts at Patos a great many rats were killed by eating bran mash, and it is possible that it may prove of use against the rats infesting cacao estates in the Northern Range of Trinidad and in Tobago.

The species of rat occurring at Patos is *Mus alexandrinus*. The same species also makes its home on cacao estates. The long tailed cacao rat *Rhipidomys couesi*, living on trees and found in the Northern Range of Trinidad may not take this bait, and experiments are necessary to determine this.

The Bran mash is prepared as follows:—

I.	Paris green or white arsenic	2½ lb.
	*Bran	50 lb.

Mix these dry.

II.	Molasses	4 quarts.
	Water	5 gallons.

Mix these two together thoroughly.

Mix I and II, then add sufficient water to make a wet mash.

Caution:—Do not add the water to make up the mash until the day the poison is to be distributed.

A small quantity of the mash should be put in coconut shells or pieces of split bamboo and placed in the forks of the trees or near the holes of the rats; due precaution being taken to prevent domestic animals getting at it. Birds should be safeguarded as much as possible, by putting out the poison late in the afternoon, and removing it in the morning when not consumed.

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* Coconut meal can be used instead of bran.

INSECTS INFECTING THE COTTON PLANT IN TRINIDAD.

By F. W. Urich,
Entomologist, Board of Agriculture.

BUGS.

(1.) *Dysdercus howardi*, Ballou.

(2.) *Dysdercus howardi*, var. *minor*, Ballou.

Common name :—Cotton Stainer.

Natural enemies :—The cotton stainer does not appear to have many natural enemies among insects. Occasionally it is parasitized by a species of *Trichopoda*, but the percentage of parasitism is a very small one.

Status :—The Cotton Stainer is the worst pest of cotton in this island.

Control :—Hand-picking, trapping and destruction of food-plants growing wild, viz., Gemauve, *Malachra capitata*, *sida glomerata*, Silk cotton (*Eriodendron anfractuosum.*) For further particulars see *Circular No. 6, Board of Agriculture.*

(3.) *Hypselonotus fulvus*, de Geer.

Determined by Mr. Otto Heidemann through Dr. L. O. Howard.

Common name :—The Yellow Hypselonotus.

Status :—Not a pest, but found mostly on Gemauve, (*Malachra capitata.*) It comes to cotton during the flowering period.

(4.) *Sphictyrtus intermedius*, Stal.

Determined by Mr. Otto Heidemann through Dr. L. O. Howard.

Common name :—The Metallic Sphyctyrtus.

Status :—Found on cotton about the flowering period, but occurs also on black sage (*Cordia cylindrostachya.*)

(5.) *Largus lunatus*, Fabr.

Determined by Mr. Otto Heidemann through Dr. L. O. Howard.

Common name :—The Brown largus.

Status :—Not a pest, occurs on *sida glomerata* also.

(6.) *Sphyrocoris obliquus*, Germ.

Determined by Imperial Bureau of Entomology.

Common name : The hemispherical Sphyrocores.

Natural enemies:—The eggs are parasitized by an Hymenopteron ***Trissolcus Trinidadensis***, Cwfd.

Status :—Found in the young and adult stages in old cotton bolls left over in the field, it does not appear to attack fresh tissues.

CATERPILLARS.

(7.) *Alabama* (*Aletia*) *argillacea.*

Common name :—The Cotton worm.

Natural enemies :—The Jack Spaniard, *Polistes canadensis* and other species prey extensively on the caterpillars. A Tachina fly *Phorocera* sp. is also an efficient parasite on the caterpillar.

Status :—As a rule the cotton worm is kept in check by natural enemies, but occasionally after heavy dry seasons there are large outbreaks.

Control :—Dust or spray with arsenicals. Arsenate of lead paste in proportion of 4 lb. paste to 50 gallons water can be used; also Paris green or dry arsenate of lead mixed with starch in the proportion of one part of the former to 30 parts of the latter is suggested by Sands, consul *Agricultural News*, November 6, 1915, page 362.

PLANT LICE OR APHIDES.

(9.) *Aphis* species.

Common name :—The cotton aphis.

Natural enemies :—The cotton aphis is preyed upon by larvæ of Syrphid flies, and the beetles *Megilla maculata*, de Gern, *Cycloneda sanguinea* L. and *Scymnus auritulus*, Muls. (all determined by Imperial Bureau of Entomology.

SCALE INSECTS.

(10.) *Hemichionaspis minor*, Mask.

Common name :—The Snowy scale.

Natural enemies :—This scale is parasitized by a minute hymenopteron, *Aspidiotiphagus citrinus.*

Status :—Not a serious pest.

(11.) *Saissetia nigra*, Nietn.

Common name :—"The Black Scale."

Natural enemies :—The Coccinellid beetle *Azaya orbigera*, Muls. is predaceous on this scale. It is also destroyed by an internal parasite *Lecaniobius cockerlli*, Ashm.

Status :—Not a serious pest on cotton in Trinidad.

BOTANICAL.

EXPERIMENT IN SHIPPING DURIAN SEEDS.

It is often thought that seeds which are to be sent long distances should be thoroughly dried and packed as dry as possible to insure a good germination. The following experiment made with seeds of the famous Malayan fruit the durian (*Durio zibethinus*) shows that this is not always the case.

On May 4, 1915, Dr. P. J. S. Cramer, Chief of the Plant Breeding Station, Buitenzorg, Java, sent by parcels post three boxes, each of which contained four durian seeds. These seeds are moderately large, about ¾ to one inch long and ½ inch or more in diameter. The boxes were all the same size, namely, 4 x 3 x 2 inches. The seeds were loosely packed with charcoal mixed with coconut fibre refuse. Box No. 1 was packed dry; 25 cub. cm. of water was added to box No. 2; and 50 cub. cm. of water to box No. 3. The seeds reached Trinidad on July 6, having been two months on the way.

When the boxes were opened it was found that all the seeds in box No. 1 had dried up completely and were mere shells which could be crushed between the fingers. In box No. 2 there were two good seeds which had already begun to germinate while the other two were rotted. In box No. 3 all the seeds were good and had germinated en route, but one had grown so much that the shoot was badly broken. The seeds were handled carefully and planted in pots in a mixture of coconut fibre refuse and sand. One plant got broken off accidentally but the other four have grown well, three now being fourteen inches high and one twenty inches high.

As the durian seed has the reputation of being a difficult shipper, four plants from twelve seeds after a journey of two months would seem to be very good. With many similar seeds it is probably principally a question of giving the right degree of moisture to the packing material.

J. B. R.

AGRICULTURAL EDUCATION.

CACAO & VEGETABLE PRIZE COMPETITIONS 1916-17.

THE Board of Agriculture offers prizes to the value of 923 dollars for the encouragement of good cultivation of Cacao and Vegetables by Peasant Proprietors and Contractors.

Cacao Prize Competition.

RULES.

1. Prizes will be awarded for good cultivation of cacao.

2. The prizes will be awarded in two classes.

CLASS I.—For Peasant Proprietors with not more than 16 acres in Cacao cultivation altogether and in one piece.

CLASS II.—For Contractors.

3. No Peasant Proprietor will be allowed to compete in Class I unless he or she has 5 acres in bearing cacao, and no contractor will be allowed to compete in Class II who has less than 3 acres in trees three years old at the time of entry.

4. No person can compete in more than one class. Previous Prize Winners can only compete under Rule 8.

5. Prizes will not be awarded unless there are at least 50 competitors in each of the Classes I and II in each district.

6. The Prizes offered in *each* district are as follows :—

	1st	2nd	3rd	4th	5th	6th	7th
Class I.—Peasant Proprietors—	$80	$60	$40	$30	$20	—	—
Class II.—Contractors —	$60	$45	$30	$20	$15	$10	$5

7. The two districts in which the above prizes are offered for competition in 1916-17, are :—

(1.) Oropuche and Erin Districts.
(2.) Guaracara and Piparo Districts.

8. Four Special Prizes and Medals are also offered for competition amongst the prize winners in the previous competitions in the above two districts and Arima, Manzanilla, Savana Grande, St. Ann's, Diego Martin, Brasso, Couva, Chaguanas, Oropuche and Erin Districts.

(*a.*) Peasant Proprietors	—1st Prize $20 and Medal.
	—2nd Prize $10 and Medal.
(*b.*) Contractors	—1st Prize $10 and Medal.
	—2nd Prize $5 and Medal.

These four prizes are for the whole of these districts, not four in each district.

9. The competition will be for the period January 1, 1916, to March 31, 1917.

10. In judging, marks will be given under the following heads :—

(1.) Tillage	50 points.
(2.) Sanitation of the cacao field, and treatment of diseases	30 ,,
(3.) General, including crop records, live stock, and any special features	20 ,,

11. The method of cultivation and condition of the trees, together with the circumstances of each cultivation, the characteristics of the locality and the implements used, will be considered by the judges. In judging, the condition of young cultivation, if any, will be taken into account.

12. The Board, on the report of the Judges, may withhold or alter the value of any or all of the prizes if the cultivations entered for competition are not considered of sufficient merit.

13. Due notice will be given before the judging commences, and the decision of the Board will in all cases be final.

14. Applications for rules and entry forms should be made at:—

The District Ward Offices; Post Offices; Agricultural Inspectors residences; the Wardens' Office in the district, or at the office of the Department of Agriculture, Government Buildings, Port-of-Spain.

ENTRY TO COMPETITION—FREE.

Entries may be sent post free if addressed to:

The Agricultural Inspectors.

The Director of Agriculture, Port-of-Spain.

Entries will be received up to March 31, 1916.

The Board's Inspectors will visit all holdings entered for competition and give advice as to the best methods of cultivation free of any charge.

Vegetable Cultivation Prize Competition.

RULES.

1. Prizes will be awarded for the best cultivated garden as in Rule 3.

2. The prizes will be awarded during 1916, in the Oropuche and Erin Districts.

3. Prizes to be given as follows:—

OROPUCHE–ERIN DISTRICTS.

Best acre banana or plantain	$10
Best ½ acre cassava	10
Best ¼ acre black-eyed peas	10
Best ¼ acre sweet potato	12
Aggregate prize	6
	$48

Cassava, black-eyed peas and sweet potato may be planted in the same ½ acre.

4. The competition will be for the period of eleven months from January 1, to November 30, 1916.

5. Prizes will not be awarded unless there are at least 10 competitors in each class.

6. In judging, marks will be given under the following heads:—

1. Tillage	50 points.
2. Cultivation	25 ,,
3. Sanitation and treatment of disease ...	15 ,,
4. General	10 ,,

The method of cultivation and condition of plants together with the circumstances of each cultivation, the characteristics of the locality and the implement used will be considered by the judges.

7. The Board on the report of the Judges may withhold or alter the value of any or all of the prizes if the cultivations entered for competition are not considered of sufficient merit.

8. Judging will take place as follows:—

Black-eyed peas and sweet potato in June to July, 1916.

Banana or plantain and cassava in November, 1916.

Due notice will be given before the judging commences, and the decision of the Board will in all cases be final.

9. Application for rules and entry forms should be made at:—

The District Ward Offices; Post Offices; Agricultural Inspectors' residences; the Warden's Office in the district, or at the office of the Department of Agriculture, Government Buildings, Port-of-Spain.

ENTRY TO COMPETITION—FREE.

Entries may be sent post free if addressed to:—

The Agricultural Inspectors.

The Director of Agriculture, Port-of-Spain.

Entries will be received up to March 31, 1916.

The Board's Inspectors will visit all holdings entered for competition and give advice as to the best methods of cultivation free of any charge.

Prizes already awarded.

Ninety-one prizes of the total value of $3,044 have already been awarded to the following Peasant Proprietors and Contractors in the six centres in which competitions have been held:—

1911.

ARIMA AND MANZANILLA.

Class i.—

1st Prize	William Walcott	$50
2nd ,,	Apool J. Baptiste	40
3rd ,,	James A. Reid	20
4th ,,	Christopher Pilgrim	12
5th Prize	Richard Jackson	3
	Philip Abraham	3

Class ii.—

1st Prize	Joseph Hogan	25
2nd ,,	Geo. de Souza	20
3rd Prize	Noble Thomas	8
	Wm. Chinawing	8
5th ,,	George Frederick	3

BRASSO, COUVA AND CHAGUANAS.

Class i.—

1st Prize	Augusta Martin	$96
2nd ,,	Kanhai Meah	72
3rd ,,	Gunga Dial Doorbal	36
4th ,,	Alexander S. Lee	24
5th Prize	Augustine John	12
	C. D. Lalla	12

Class ii.—

1st Prize	Brathwaite Joseph	96
2nd ,,	A. Soloman	72
3rd ,,	George Ottley	36
4th ,,	Jean Didier Sevierre	24
5th ,,	Benjamin Croney	12

1912-13.

ST. ANN'S AND DIEGO MARTIN.

Class i.—(Peasant Proprietors.)

1st Prize	A. H. Romany	$90
2nd ,,	Ramdial	65
3rd ,,	J. Norgriff	45
4th ,,	C. Ollivierre	30
5th ,,	M. T. Bodu	20

Class ii.—(Contractors.)

1st Prize	Soomaroo	85
2nd ,,	Julen Joseph	60
3rd ,,	Seano Joseph	40
4th ,,	Samuel Claude	25
5th ,,	J. La Rose Timson	15
6th ,,	Howard Nicholas	10
7th ,,	Francis Littrean	5

SAVANA GRANDE.

Class i.—(Peasant Proprietors.)

1st Prize	T. L. Bernard	$90
2nd ,,	Alberton W. Watts	65
3rd ,,	Badri Maharaj	45
4th ,,	William Perry	30
5th ,,	Gocool	20

Class ii.—(Contractors.)

1st Prize	Joseph Daniel	85
2nd ,,	Fitz Herbert Allen	60
3rd ,,	Charles Brown	40
4th ,,	Arthur Richardson	25

1913-14.

St. Ann's and Diego Martin.

Class i.—(Peasant Proprietors.)

1st	Prize	Sylvestre Pequette	$90
2nd	,,	Lallsingh	55
2nd	,,	Julian Webster	55
4th	,,	Ramlochan	30
5th	,,	John Edward	20

Class ii.—(Contractors.)

1st	Prize	Sumarie	60
2nd	,,	Louis Thomas	50
3rd	,,	James Simeon	30
4th	,,	Gungadeen	20
5th	,,	James Johnson	15
6th	,,	Emile Joseph	7.50
6th	,,	Felix Pamella	7.50
8th	,,	Hubert Capriata	5.00

Couva and Chaguanas.

Class i.—(Peasant Proprietors.)

1st	Prize	George L. Payson	$90
2nd	,,	Julien Charles	65
3rd	,,	Cleto M. Hospedales	45
4th	,,	Quitterro McLarris	30
5th	,,	Bissessar & Batchia	20

Class ii.—(Contractors.)

1st	Prize	Edward Ford	60
2nd	,,	James Catterson	50
3rd	,,	J. M. Piemental	30
4th	,,	Bernard Hector	20
5th	,,	Padai	15
6th	,,	George Henry	7.50
6th	,,	Joseph Luke	7.50
8th	,,	Joseph Alexander	5.00

Special Competition.

Class i.—(Proprietors.)

1st	Prize	Kanhai Meah—Medal and	$20
2nd	,,	Apollo H. Romany—Medal and	$10

Class ii.—(Contractors.)

1st	Prize	Benjamin Croney—Medal and	$10
1st	,,	Soomaroo—Medal and	10
2nd	,,	A. P. Baptiste—Medal and	$5
2nd	,,	T. Joseph—Medal and	$5

1914-15.

Oropuche and Erin Districts.

Class i.—(Peasant Proprietors.)

1st	Prize	Lalgee	$80
2nd	,,	Lutchman	60
3rd	,,	Laurence Hilaire	40
4th	,,	Mahabir	30
5th	,,	Mahabir Goongal	20

Class ii.—(Contractors.)

1st	Prize	Hosanee	$60
2nd	,,	Joseph Lilla	45
3rd	,,	Joseph Augustin	30
4th	,,	Freeling Lewis	20
5th	,,	James Nichols	15
6th	,,	Mark Dorset	10
7th	,,	Teekaram	5

Brasso Piparo District.

Class i.—(Peasant Proprietors).

1st	Prize	Nogina	$80
2nd	,,	J. West	60
3rd	,,	E. Mota	40
4th	,,	C. L. Legendre	30
5th	,,	E. Nicholas	20

Class ii.—(Contractors).

1st	Prize	Clifford Worrell	$60
2nd	,,	Benworrie (Bonawa)	45
3rd	,,	Bryon Bristol	30
4th	,,	Willie Jules	20
5th	,,	H. Legendre	15
6th	,,	Phoolbasia	10
7th	,,	Charles Welcome	5

Special Competition.

Class i.—(Peasant Proprietors.)

1st	Prize	Lallsingh—Medal and	$20
2nd	,,	Cleto M. Hospedales—Medal and	$10

Class ii.—(Contractors.)

1st	Prize	Edward Ford—Medal and	$10
2nd	,,	Sumarie—Medal and	$5

BOARD OF AGRICULTURE,
TRINIDAD AND TOBAGO.

Vegetable Cultivation Prize Competition 1916.

ENTRY FORM.

.............................191 .

Ward Union..
Ward..
District..
Main Road..
Local or Ward Road..
Nearest Mile Post..
Name of Property..
Name of Proprietor..
Competitor's Name (in full)..
Place of residence of Competitor..
....
Postal Address..
....

OROPUCHE AND ERIN DISTRICTS.

Cassava	...	...	...	...	½ acre.
Sweet Potato	...	...	...	...	¼ „
Banana or Plantain		...	...	...	1 „
Black-eyed Peas ...		...	...	...	¼ „

....*Signature.*

NOTE.—Make a CROSS × opposite to the vegetable or vegetables you wish to enter for competition.

BOARD OF AGRICULTURE,
TRINIDAD AND TOBAGO.

Cacao Prize Competition 1916-17.

ENTRY FORM.

.............................191 .

Ward Union..
Ward..
District..
Main Road..
Local or Ward Road..
Nearest Mile Post..
Name of Property..
Name of Proprietor..
Competitor's Name (in full)..
Place of residence of Competitor..
....
Postal Address..
....
Whether Peasant Proprietor or Contractor..
Total Acreage..
Acreage under Cultivation..
No of Bearing Trees (*if a proprietor*)..
Number of Trees three years old (*if a contractor*)..

....*Signature.*

STOCK.

RECOMMENDATIONS OF THE TOBAGO FARM COMMITTEE.

The following recommendations of the Tobago Farm Committee were discussed and agreed to by the Board of Agriculture in December. They have since been approved by His Excellency, the Acting Governor, 22 December, 1915, (M.P. 3488/15):—

1. That in order to relieve the somewhat heavy demand for the services of the stallion, which at times occurs, two stallions should be provided in the following manner: (*a*) one to be permanently kept at the Farm at a fee of $4 80, (£1) and (*b*) another to be supplied from Trinidad as occasion demands for special services at a fee of $10 provided that a sufficient number of bookings are obtained.

2. That experiments in artificial impregnation of mares be undertaken at the Farm, the stallion "Monolier" to be made available for the purpose.

3. That the fee for the Shorthorn bull be reduced from 6s. 3d. to 4s. with free service to all regular pasture renters, and that the service of the two half-bred bulls be given free to all cows regularly pastured at the Farm.

4. That the front lands of the Farm between the Milford Main Road and the ridge bordering the present site of the recreation ground be offered in building lots under leases for 99 years. This is subject to conditions being imposed as to the class of houses to be erected thereon.

THE HACKNEY STALLION "SIR HORRY."

This stallion (Fig. 1.) was imported in 1907 for the Tobago Farm but was transferred to Trinidad after a few years during which he was not sufficiently patronised by Tobago planters owing to his small size.

He has to his credit several nice foals in Trinidad. Docility, speed, and a strong body are characteristic of his progeny.

The one shown here (Fig. 2.) is the property of the Government and is kept at River estate. It was named "Lady Lamont" as the estate formerly belonged to the Lamont family.

Another foal at the Government Farm Trinidad is likely to be kept as a stud. His dam was one of the fastest American trotters ever mported into Trinidad.

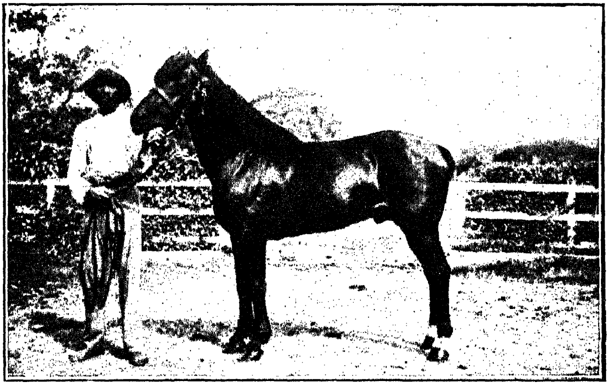

FIG. 1.—" Sir Horry."

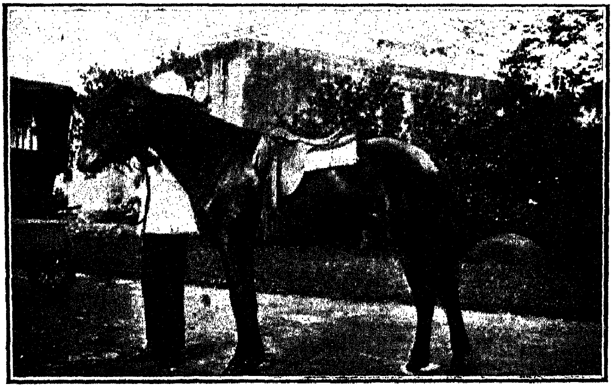

FIG. 2.—" Lady Lamont."

THE CURE OF STERILITY IN COWS.

From the experience he acquired as Director of the Veterinary College at Stuttgart, R. Reinhardt recommends the following methods for curing the different diseases causing sterility in cows. He does not deal with diseases which have a general cause, but limits himself to those affecting the reproductive system.

INTERNAL CURATIVE METHODS.

1. *Remedy for deficiency, excessive brevity or weakness of heat*; cantharidine either administered in milk in proportion of 4–6 gms. daily, or as a tincture (20 gms), Joimbin gives as a rule good results; but its high price prevents its general use.

2. *Against too violent or too frequent heat*; bromide of potassium which however only has effect for the period at which it is given.

3. *For chronic catarrhal or purulent endometritis*; copaiba balsam and oil of turpentine mixed in equal proportions. Two spoonfuls of this mixture are to be taken fasting in milk every morning for 4 to 6 weeks. For the first 7 or 8 days the catarrhal flux increases and is sometimes attended by pain but it gradually diminishes and ceases. After 4 to 6 weeks as a rule the animal is cured and shows the normal signs of heat and conception. The milk does not acquire any turpentine odour from this treatment. Naturally the internal treatment is still more efficacious if accompanied by local treatment.

LOCAL OR SURGICAL METHODS OF TREATMENT.

1. *Failure in conception* was in some cases successfully treated by washing with a 0·5 per cent. of bi-carbonate of soda before mating specially where conception was hindered by an excessive accumulation of secretion at the base of the vagina; this was dissolved and removed by the washing. This treatment does not act by changing the acid reaction of the secretion (which would destroy the spermatozoa) into an alkaline one, for only in one of the 98 cases examined by the writer was the reaction of the secretion acid.—(*Bulletin of Agricultural Intelligence and Plant Diseases.* March, 1915.

CATTLE FOODS.

The increasing prices of imported cattle foods make it more necessary than before that stock owners should endeavour to find local substitutes that would answer the purpose nearly as well as those which have long been regarded as standard foods.

At certain times there is an abundance of Indian corn obtainable at a low price in comparison with imported corn, and it remains a matter for regret that local kilns have not been erected long before this which would enable the Colony to lay up a stock of corn for use during the off season.

The concentrated fodders available in the Colony are mainly two viz., Indian corn and coconut meal. The first represents the type of starchy foods, the second the oil meal type. A combination of the two can be used in certain cases. Cotton seed meal is easily obtainable in the West Indies, and this can be substituted for coconut meal when required.

The following is a recent table of food values containing many foods of local interest and some the value of which had not previously been ascertained and published:—

NAME.	Water.	Oil.	Albuminoids.	Digestible Carbohydrates.	Woody Fibre.	Mineral Matters.	Sand and Silica.	“ Food Units.”
Wheat, pollards	10·70	3·60	14·25	56·73	8·57	6·15	1·55	101
Bran	11·45	4·33	16·46	57·01	6·50	4·25	...	109
Oats, crushed	13·45	6·77	11·12	36·92	9·14	2·60	0·85	102
White Jowaree meal (Guinea corn) Karachi... ...	10·65	3·43	9·75	71·53	1·79	2·85	0·75	104
Maize, old, average ...	11·25	4·80	10·20	70·17	1·85	1·73	..	108
,, North America, mixed	12·55	4·37	10·62	69·71	1·50	1·25	...	107
Corn meal	12·45	4·20	10·01	70·15	1·96	1·25	...	105
Corn cob meal	11·05	0·80	2·00	56·18	28·52	1·45	0·30	63
Millet Rangoon	12·40	3·13	10·62	70·34	1·41	2·10	0·25	104
Rice (cleaned)	11·80	2·40	8·01	75·88	0·76	1·15	...	102
Rice meal, Demerara ...	9·00	21·37	12·63	41·35	5·80	9·85	4·65	126
Soya Beans: Argentine (from Manchurian seed) ..	14·05	19·90	32·13	24·34	4·08	5·50	0·05	154
Peas: Canadian	13·95	1·93	24·31	52·91	4·20	2·70	...	119
Locust or Carob beans ...	13·40	1·01	4·87	72·24	5·62	2·80	0·05	87
Saman beans (*Pithecolobium Saman*)	14·25	0·50	11·50	60·33	10·87	2·55	0·05	90
Linseed, La Plata... ...	7·92	35·12	22·36	24·82	5·82	3·96	0·11	168
Linseed cake, English-make, average	11·16	9·50	29·50	35·54	9·10	5·20	0·60	133
Cottonseed Egyptian ..	8·80	23·93	19·56	21·54	21·16	5·01	0·80	130
Decorticated cotton cake meal, North American Gulf ports	7·85	8·70	46·80	25·48	6·25	5·25	0·05	163
Undecorticated cotton cake, West Indian	10·15	6·39	26·25	33·51	18·80	4·70	0·10	116
Whole seed cotton meal (from cleaned seed)	10·60	23·57	21·62	23·75	16·06	4·40	0·35	137
Coconut	16·13	58·23	5·44	14·26	4·36	1·58	...	159
Copra, South sea	4·15	67·67	8·25	15·70	2·33	1·90	...	206
“Eaba palm” seeds Demerara	27·50	0·30	4·25	44·48	21·47	2·00	...	58
Candle nuts	4·55	63·43	22·13	3·81	2·08	4·00	0·05	218
Para rubber seeds (*Hevea brasiliensis*) ...	11·00	24·87	9·53	22·55	30·40	1·55	...	...
Cohune nuts (kernels) ...	6·25	69·71	7·50	12·62	2·07	1·85	...	206
Ground nuts, Rangoon ...	7·90	39·03	20·50	12·84	17·58	2·15	0·10	161
Sunflower seed cake ...	7·10	7·43	19·01	28·93	30·03	7·50	2·65	95
Sunflower seed cake, husked...	7·75	10·03	37·00	21·14	16·53	7·55	2·20	139
Cacao, Guayaquil	3·55	47·20	15·38	27·39	2·53	3·95	0·15	183
Cacao, shells	9·30	3·83	18·81	46·01	13·85	8·20	0·85	102
Manioc-roots meal, Java ...	11·70	0·70	2·63	81·62	1·65	1·70	0·10	90
Treacle	22·22	...	...	71·28	...	5·80	...	71
Dried brewer's grain ...	10·01	6·93	19·50	42·31	17·60	3·65	1·75	108
Megass meal	11·10	1·47	2·00	51·88	30·10	3·45	2·25	60

NOTES.

The Agricultural Credit Societies Ordinance has been passed, No. 30 of 1915.

The Hon. H. A. Alcazar, K.C., has resigned from the Board of Agriculture and His Excellency the Acting Governor has appointed Mr. C. S Rogers, Forest Officer, to the vacant position.

Mr. W. G. Freeman, Assistant Director of Agriculture returned from Canada on December 3, and resumed the duties of his appointment.

Mr. André Devenish, Secretary of the Board of Agriculture resigned, on December 31, 1915 to return to his substantive appointment in the Civil Service of the Colony. Mr. J. B. Rorer has been appointed as Honorary Secretary for three months from January 1.

Mr. C. Buthn was appointed acting Curator of the Botanical Department, Trinidad from January 1, 1916. He had previously been acting as temporary Assistant.

The Board of Agriculture has contributed £40 towards the expenses of the Agricultural Exhibiton held by the Naparima District Agricultural Society at San Fernando on January 31. His Excellency the Acting Governor, the Hon. S. W. Knaggs, C.M,G., was present.

The exhibits on the whole were of high quality, sugar canes and poultry being particularly good.

The Department and Board of Agriculture, the Forestry Department and the Education Department all contributed exhibits.

Mr. R. O. Williams of the Royal Botanic Gardens, Kew, has been selected for the post of Curator in the Botanical Department. Mr. Williams is expected in February.

METEOROLOGY.

RAINFALL RETURN FOR NOVEMBER AND DECEMBER, 1915, AND TOTALS FOR 1915 & 1914.

STATIONS.	Nov., 1915.	Nov., 1914.	Dec., 1915.	Dec., 1914.	Jan. to Nov., 1915.	Jan. to Nov., 1914.	Jan. to Dec., 1915.	Jan. to Dec., 1914.
North West District.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
St. Clair—Royal Botanic Gardens ...	7·84	7·61	1·75	5·58	54·56	48·54	56·31	54·12
Port-of-Spain—Colonial Hospital ...	5·43	4·50	1·45	5·03	41·03	36·50	42·48	41·53
,, Royal Gaol ...	5·71	5·22	2·36	5·80	47·75	40·57	50·11	46·37
,, Constabulary Head-quarters ...	...	...	...	...	...	...	...	...
St. Ann's—Reservoir	7·67	9·88	1·66	4·73	61·49	51·28	63·15	56·01
Maraval—Reservoir	7·63	10·50	2·44	4·30	61·99	52·24	64·43	56·54
,, Constabulary Station ...	8·92	9·30	1·87	5·73	76·06	59·25	77·93	64·98
Diego Martin ,, ,, ...	8·96	6·97	2·87	5·32	66·68	53·64	69·55	58·96
,, ,, Waterworks ...	9·21	6·54	2·82	4·81	63·21	53·81	66·03	58·62
,, ,, River Estate ...	8·39	6·03	2·85	4·80	63·28	52·76	65·13	57·56
Fort George Signal Station ...	8·16	8·99	1·14	5·58	60·15	55·97	61·29	61·55
North Post ,, ...	9·34	5·11	3·66	3·55	55·25	47·58	58·91	51·13
Carenage Constabulary Station ...	12·39	8·99	2·46	7·67	67·52	68·33	69·98	76·00
Carrera Island Convict Depôt ...	7·93	3·46	1·73	4·60	42·98	44·95	44·71	49·55
Chacachacare Light House ...	4·56	1·98	3·40	5·69	42·08	36·55	45·48	42·24
Santa Cruz—Maracas District.								
Santa Cruz Constabulary Station ...	7·19	8·70	4·10	3·23	60·33	57·66	64·43	60·89
St. Joseph, Government Farm ...	4·95	7·00	1·46	7·56	55·74	45·13	57·20	52·69
St. Joseph Constabulary Station ...	4·71	5·59	1·15	5·55	39·24	39·18	40·39	44·73
Tunapuna, St. Augustine Estate ...	5·20	8·18	2·05	7·44	51·62	42·92	53·67	50·36
Maracas—Government School ...	7·06	8·78	2·44	5·11	57·80	56·78	60·24	61·89
,, Ortinola Estate ...	5·52	10·18	2·79	6·26	58·94	50·90	61·73	57·16
Caura, Wardour Estate	6·14	11·34	2·83	6·60	52·03	48·32	54·86	54·92
West Central District.								
Caroni, Frederick Estate	6·10	9·72	3·59	9·06	63·32	93·03	66·91	102·09
Chaguanas, Constabulary Station ...	7·77	4·66	3·26	8·77	63·91	43·90	67·17	52·67
Chaguanas, Woodford Lodge Estate ...	6·33	4·94	2·85	8·32	61·37	45·82	64·22	54·14
Carapichaima, Waterloo Estate ...	6·96	6·54	4·16	5·69	57·82	40·81	61·98	46·50
,, Friendship Hall Estate...	8·40	7·15	...	7·75	67·96	44·66	...	52·41

RAINFALL RETURN FOR NOVEMBER AND DECEMBER, 1915, & TOTALS FOR 1915 & 1914.—CONTD.

STATIONS.	Nov., 1915.	Nov., 1914.	Dec., 1915.	Dec., 1914.	Jan. to Nov., 1915.	Jan. to Nov., 1914.	Jan. to Dec., 1915.	Jan. to Dec., 1914.
	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
West Central District.—Contd.								
Couva, Exchange Estate	3·78	5·54	3·05	5·02	55·91	38·88	58·96	43·90
,, Brechin Castle ,,	4·21	6·77	4·48	6·00	55·81	45·13	60·29	51·13
,, Perseverance ,,	3·81	6·73	3·56	5·93	52·73	48·45	56·29	54·38
,, Camden ,,	4·22	5·65	3·22	5·98	43·17	37·99	46·39	43·97
,, Milton ,,	3·68	6·56	5·02	6·83	62·33	46·14	67·35	52·97
,, Spring ,,	4·61	7·12	3·14	8·05	66·00	43·45	69·14	51·50
,, Constabulary Station	3·89	6·33	2·99	6·02	55·42	44·89	58·41	50·91
,, Esperanza Estate, Savonetta	4·47	6·17	4·88	5·05	56·13	42·03	61·01	47·08
Montserrat District.								
Montserrat, Constabulary Station	6·46	8·08	4·30	7·22	65·23	46·56	69·58	53·78
Brasso, La Vega Estate	7·87	7·64	5·61	11·59	86·07	56·30	91·68	67·89
Arima District.								
Arima, Warden's Office	8·36	3·26	3·32	7·56	55·14	41·38	58·46	48·94
Arima, Torrecilla Estate	9·78	9·96	4·53	15·11	73 72	69·12	78·25	84·23
Arima, Verdant Vale Estate	9·39	8·72	5·69	11·00	73·12	64·84	78·81	75·84
San Rafael, Constabulary Station	9·72	8·89	6·57	15·44	86·29	71·19	92·86	86·63
Guanapo, Talparo Estate	11·05	8·18	7 65	11·52	85·98	58·21	93·63	69·73
Guanapo, San José Estate	10·70	10·35	8·33	14·28	87·81	...	96·14	...
Tamana, Santa Marta Estate	11·07	12·50	7·07	16·02	91·54	74·05	98·61	90·07
,, La Corona Estate	12·53	...	8·57	...	...	...	...	...
San Fernando & Princes Town District.								
Claxton's Bay, Forres Park Estate	4·53	4·21	1·97	4·41	54·51	32·73	56·48	37·14
Pointe-à-Pierre, Bonne Aventure Est.	6·34	7·60	3·53	8·35	60·79	43·87	64·32	52·22
,, ,, Concord Estate	6·20	7·23	4·46	7·12	65·40	47·52	69·86	54·64
,, ,, Plein Palais Estate	5·13	5·76	4·58	4·80	53·33	40·11	58·41	44·91
Naparima, Picton Estate	8·07	6·22	4·65	9·02	59·71	36·20	64·36	45·22
,, Usine Ste. Madeleine Est.	7·00	5·50	4·91	8·94	57·22	41·71	61·13	50·65
,, La Fortunée Estate	7·49	7·69	4·06	7·59	53·71	41·75	57·77	49·34
,, Lewisville	7·21	5·13	5·05	8·29	65·52	46·57	70·57	54·86

RAINFALL RETURN FOR NOVEMBER & DECEMBER, 1915, & TOTALS 1915 & 1914.—CONTINUED.

STATIONS.	Nov., 1915.	Nov., 1914.	Dec., 1915.	Dec., 1914.	Jan. to Nov., 1915.	Jan. to Nov., 1914.	Jan. to Dec., 1915.	Jan. to Dec., 1914.
San Fernando & Princes Town District.—(Contd.)	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
Naparima, Tarouba Estate... ...	5·11	3·62	3·01	4·24	45·03	31·34	48·04	35·58
,, Union Hall Estate ...	6·55	5·85	5·12	7·36	47·46	39·26	52·58	46·62
,, Palmiste ,, ...	6·90	6·63	5·38	8·41	62·41	42·11	67·79	50·52
,, Hermitage ,, ...	6·75	5·83	4·78	8·12	55·20	40·15	59·98	48·27
Princes Town Craignish Estate ...	8·18	5·64	5·99	11·30	64·15	47·50	70·14	58·80
,, Cedar Hill Estate ...	7·09	5·69	6·29	10·44	61·41	45·47	67·70	55·91
,, Williamsville Estate ...	7·00	7·76	5·38	9·09	71·95	49·64	77·33	58·73
,, Esmeralda Estate ...	7·49	6·97	4·76	9·53	71·56	52·51	76·32	62·04
,, New Grant Estate ...	7·78	6·48	8·76	14·01	76·23	57·68	84·99	71·69
,, Constabulary Station ...	5·47	5·40	2·87	7·77	44·08	32·52	46·95	40·29
,, Hindustan Estate ...	8·25	5·13	7·37	12·12	66·87	47·65	74·24	59·77
,, La Retraite Estate ...	7·40	8·42	7·69	15·32	73·57	74·69	81·26	90·01
,, Malgretoute ,, ...	10·98	5·66	5·77	10·44	70·96	45·01	76·73	55·45
Sav. Grande, Friendship & Ben Lomond Estates	8·79	6·23	4·97	9·60	63·09	46·72	68·06	56·32
Poole, El Rosario Estate	9·73	8·44	8·28	15·39	89·98	61·50	98·26	76·89
South-West District.								
Oropuche, Constabulary Station ...	9·23	9·31	5·48	8·57	65·26	58 48	70·74	67·05
,, Pluck Estate	5·69	7·03	5·62	9·65	58·30	45·91	63·92	55·56
Siparia, Constabulary Station ...	11·25	11·68	7·62	14·74	83·15	69·46	90·77	84·20
,, Alta Gracia Estate ...	9·61	8·56	7·10	11·19	64·52	...	71·62	...
Guapo, Adventure Estate ...	6·86	5·98	6·10	9·15	54·37	50·20	60·47	59·35
Cap-de-Ville—Constabulary Station ...	9·13	8·22	7·74	8·94	66·29	72·31	74·03	81·25
Erin, La Ressource Estate ...	4·42	5·65	5·98	12·02	49·22	50·79	55·20	62·81
,, Industry Estate	7·62	6·17	4·40	10·65	56·64	53·51	61·04	64·16
Cedros, La Retraite Estate ...	8·50	...	5·55	...	58·38	...	...	...
,, Constabulary Station ...	3·36	4·23	7·38	6·37	41·88	47·29	49·26	53·66
,, Beaulieu Estate	2·40	...	5·61	...	...	...	...	...
,, Perseverance Estate ...	2·98	4·41	7·21	6·67	41·85	45·36	49·06	52·03
,, Ste. Marie Estate	3·27	..	6·46	...	38·94	...	45·40	...

RAINALL RETURN FOR NOVEMBER & DECEMBER, 1915, & TOTALS 1915 & 1914.—CONTINUED.

STATIONS.	Nov., 1915.	Nov., 1914.	Dec., 1915.	Dec., 1914.	Jan. to Nov., 1915.	Jan. to Nov., 1914.	Jan. to Dec., 1915.	Jan. to Dec., 1914.
	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
South-West District.—(Contd.)								
Icacos, Constance Estate ...	3·20	3·00	4·81	1·17	37·85	39·85	42·66	41·02
Irois, Irois Estate	3·86	12·09	3·86	9·14	51·83	...	55·69	...
South Coast.								
Moruga, Constabulary Station ...	8·18	3·93	4·25	11·68	58·16	39·02	62·41	50·70
East Coast.								
Matura, La Juanita Estate... ...	11·03	7·23	8·71	11·80	92·29	67·07	101·00	78·87
Manzanilla, Constabulary Station ...	10·98	10·06	7·15	17·25	91·42	66·19	98·57	83·44
Sangre Grande, San Hilario Estate ...	9·52	...	5·47	...	...	...	...	...
,, New Lands Estate ...	10·22	12·12	5·14	18·87	89·94	69·63	95·08	88·50
,, Evasdale Estate ...	11·48	11·54	8·45	15·45	91·91	76·42	100·36	91·87
,, Grosvenor Estate ...	11·79	13·33	9·47	17·77	99·10	73·56	108·57	91·33
Mayaro, Constabulary Station ...	8·19	8·14	7·03	12·31	65·26	44·27	72·29	56·58
North Coast.								
Blanchisseuse, Constabulary Station ...	6·42	6·31	6·86	5·14	58·29	54·91	65·15	60·05
Grande Rivière, Mon Plaisir Estate ...	9·15	17·60	7·49	11·70	82·13	77·95	89·62	89·65
Toco, Aragua House	6·17	7·21	5·40	7·62	69·44	55·80	74·84	63·42
,, Constabulary Station ...	6·89	8·07	5·25	5·99	63·32	53·28	68·57	59·27
Point Galera, Light House ...	5·73	5·06	5·00	3·62	49·32	33·47	54·32	37·09
Tobago.								
Tobago, Hermitage Estate ...	8·47	10·05	7·13	6·63	81·96	61·99	89·09	68·62
,, Riversdale ,, ...	6·22	3·78	3·34	6·06	56·84	35·93	60·18	41·99
,, King's Bay ,, ...	8·29	7·33	7·03	5·72	77·34	50·38	84·37	56·10
,, Roxburgh ,, ...	11·33	6·74	8·06	9·58	96·91	59·35	104·97	68·93
,, Luré Estate ,, ...	11·25	7·65	6·32	8·77	92·83	61·51	99·15	70·28
,, Botanic Station	9·40	7·30	4·43	7·71	69·01	44·03	73·44	51·74
,, Government Farm ...	6·63	5·61	2·44	5·50	51·61	25·92	54·05	31·42
,, Lowlands Estate	7·39	5·91	5·13	5·33	63·61	34·33	66·74	39·66
,, Friendship ,, ...	7·68	6·54	4·03	4·71	72·53	37·16	76·56	41·87
,, Bon Accord ,, ...	5·84	...	3·14	...	62·54	...	65·68	...

BIRDS AS SEISMOSCOPES.

Mr. C. S. Rogers, the Forest Officer, has forwarded the following interesting note from an old number of the *Selborne Magazine* 1910, Vol. XXI. p. 125. It would be of interest to know whether any of the local representative of the parrot tribe give any similar warning of the weak earth tremors which occur in this region.

Geese once saved ancient Rome from destruction at the hands of its enemies, and the parrots of Mexico, particularly those of the Tierra Caliente, or hot country along the coast, have saved thousands of lives in real fact by giving warning of approaching seismic disturbances. Not alone have the tame parrots, of which there is one or more in almost every house in Mexico, done this, but the wild flocks down along the west coast have saved thousands of pounds worth of bridges and other railroad construction work from destruction. Whenever there is a heavy storm coming the parrots silently take to the highest and thickest foliaged trees in the jungle, but when an earthquake is destined to come off within the next few hours every parrot in the country immediately seeks a bare, open, level space in the wild forest and alights on the ground. The parrot being exclusively an arboreal bird this is unusual in itself; but, in addition to this, the birds, which as a rule are unbearably noisy, become suddenly silent, emitting now and again a peculiar cry which they use at no other time. This fact is amply attested by engineers of the Southern Pacific and other railroads through the parrot-infested parts of Mexico. Flights of parrots—of varying shades of colour and all sizes—frequently darken the midday sun in the Mexican hot country, and they become so tame around the camps of engineers that they are given individual names, and soon become regular pets. "Whenever we saw the parrots deserting the forests and alighting on the ground in the open spaces of the jungle we immediately withdrew the piledrivers from the bridges," we are told by Mr. C. J. Green, an engineer, just returned from eleven months work on the Southern Pacific Railway in Mexico.

"The birds," he says, "gave us sure warning of the approach of an earthquake, and we never failed to heed their warning that we did not have trouble with the piledrivers, and any steel or wooden beams standing upright were sure to be toppled over. In fact, we lost the greater part of one steel bridge because we did not pay attention to the parrots and take a great weight of cars loaded with stone off the outer end. There is, of course, no warning of these quakes, and were it not for the parrots, hundreds of the Mexican labourers working around the piers and abutments would have lost their lives. In the towns the hot country, just previously to the last series of earthquakes, one of which shocks was so disastrous to Acapulco, the people were warned by the struggles of every parrot confined in a cage throughout the length and breadth ot Mexico the earthquakes were coming on. For several hours before the heavy shocks began to come the birds were making their low and plaintive 'earthquake cries,' as the natives call them, and were trying to escape from their cages." The habit of becoming terrorised at the approach of a seismic disturbance is common to no one breed of parrots, but is as true of the tiny three inch "love birds" as it is of the great three foot macaws from the far south.

(*Bulletin, Department Agriculture, Trinidad & Tobago*, pp. 1–34. Issued Feb. 1, '16).

BULLETIN
OF THE
DEPARTMENT OF AGRICULTURE,
Trinidad and Tobago.

PART 2.] 1916. [VOL. XV.

AGRICULTURAL BANKS.

AGRICULTURAL CREDIT SOCIETIES ORDINANCE.
Trinidad and Tobago.

TRINIDAD AND TOBAGO.

No. 30—1915.

I ASSENT,

[L.S.]

S. W. KNAGGS,
Acting Governor.

December 21, 1915.

An Ordinance for the registration, encouragement and assistance of Agricultural Credit Societies.

[ON PROCLAMATION.]

BE it enacted by the Governor of Trinidad and Tobago with the advice and consent of the Legislative Council thereof as follows :—

1. This Ordinance may be cited as the Agricultural Credit Societies Ordinance, 1915. Short Title.

2.—(1.) The Director of Agriculture hereinafter called the Registrar, shall be the Registrar of Agricultural Credit Societies under this Ordinance. Registrar of Credit Societies under this Ordinance.

(2.) The Director of Agriculture may utilise as he shall think fit the services of officers of his department for the purpose of carrying out the duties imposed upon him by this Ordinance and shall appoint one such officer to be Inspector of all Agricultural Credit Societies registered under this Ordinance, (in this Ordinance referred to as the Inspector.) Inspector of Credit Societies.

3. All Credit Societies wishing to obtain the benefit of this Ordinance shall be registered thereunder. Registration necessary.

CONSTITUTION OF CREDIT SOCIETIES.

4. Any Credit Society desiring to be registered under this Ordinance shall through the Secretary make application in writing to the Registrar and shall supply him with— Registration of Credit Society.

(a.) The name and office or place of business of the Credit Society:

(b.) The names and addresses of all members of the Committee thereof;

(*c.*) The names and addresses of the Secretary, Treasurer and Trustees thereof;

(*d.*) The names and addresses of all members thereof.

Fee for registration.

5. The Secretary shall at the time of application for registration of the Credit Society pay to the Registrar a fee of one dollar.

Enquiries to be made by Registrar.

6. Before registering any Credit Society the Registrar shall, with the assistance of a Committee of which he shall be the Chairman, and which shall include the Inspector and the Warden of the Ward Union in which the Credit Society is situated, with power to add to their number not more than two other persons resident in the said Ward Union, satisfy himself with regard to such matters as may be prescribed by the regulations contained in Schedule I hereto and by any regulations to be made as hereinafter provided.

Number of members.

7. No Credit Society shall be registered which consists of less than 12 or more than 50 members, unless the Registrar shall in special cases permit a larger membership.

Registration of Credit Society.

8.—(1.) Upon the Registrar being satisfied as in Section 6 hereof mentioned, he shall register the Credit Society under this Ordinance and shall send a certificate of such registration to the Secretary thereof and shall cause the fact of such registration to be notified in the *Royal Gazette*.

Appeal from refusal to register.

(2.) The Registrar shall not be bound to give any reason whatsoever for any refusal to register a Credit Society under this Ordinance, but an appeal shall lie from any such refusal to the Governor in Executive Council, whose decision shall be final.

Governor may cancel registration.

(3.) The Governor in Executive Council shall have power for such reason as may appear good and sufficient to him, at any time, to cancel the registration of a Credit Society, registered under the provisions of this Ordinance, but notice of intention to cancel the Registration of a Credit Society shall be given to the Committee thereof, sufficient time being allowed in which representations may be made against such cancellation. Provided that such cancellation shall not be taken to effect the joint and several liability of the Trustees and every member of the Credit Society at the time of its dissolution, for the repayment of all outstanding loans made to the Credit Society during its term of registration. A notification of any such cancellation shall without undue delay be published in the *Royal Gazette* and in one at least of the local newspapers.

Book to be kept by Registrar.

9.—(1.) The Registrar shall keep a book in which shall be entered :—

(*a.*) The name and office or place of business of each registered Credit Society.

(*b.*) The names and addresses of the members of the Committee thereof;

(*c.*) The names and addresses of the Secretary, Treasurer and Trustees thereof;

(*d.*) The names and addresses of all members thereof.

(2.) It shall be the duty of the Secretary of every registered Credit Society to keep the Registrar informed of any change in the office or place of business of the Credit Society and in the names or addresses of the Secretary, Treasurer, Committee and Trustee thereof, and he shall likewise notify to the Registrar the death or withdrawal of any member of the Credit Society and the names and addresses of any new members, and the

Registrar shall make the alterations thereby rendered necessary in the book to be kept by him under the provisions of this Ordinance.

(3.) The Secretary of any registered Credit Society who shall be in default for a period of one month in giving to the Registrar any information or notification required by this section is liable to a penalty not exceeding forty shillings.

Credit Societies to be governed by rules.

10. Every Credit Society registered under this Ordinance shall be governed by such rules as are provided for in this Ordinance or as may from time to time be made thereunder.

Registered Credit Society may sue or be sued in name of Trustees.

11. A Credit Society registered under this Ordinance may sue or be sued in the Courts of the Colony in the name of its Trustees.

LOANS TO CREDIT SOCIETIES.

Loans by Board of Management.

12. There shall be a Board of Management consisting of the Receiver-General, who shall be Chairman thereof, of the Registrar and of the Crown Solicitor, which may, out of such moneys as the Legislative Council shall provide for the purpose, make from time to time advances by way of loan to any registered Credit Society applying for the same.

Provisions as to loans.

13. The following provisions shall apply to loans granted in the manner set forth in the preceding section:

(*a*.) The amount of the loan or loans to any one Credit Society shall be in the discretion of the Board of Management, but shall not be larger than in the proportion of Ten pounds to every member of the Credit Society.

(*b*.) All loans shall be for not less than twelve months and subject to any renewal which may be permitted by the Board of Management.

(*c*.) The Board of Management shall have power on being satisfied that there is good and sufficient reason therefor to call in a loan at any time, and in the event of non-payment the Attorney-General may take proceedings in accordance with the Crown Suits Ordinance, 1913.

(*d*.) All loans shall bear interest at such rate, payable half-yearly, as the Governor in Executive Council may from time to time decide.

(*e*.) All loans shall be made on the joint and several liability of the Trustees and every member of the Credit Society.

(*f*.) The Trustees on behalf of all the members of the Credit Society shall enter into an agreement for the re-payment of the loan and the payment of the interest thereon in the form set out in Schedule IV of this Ordinance.

If loan already contracted from Board of Management; Credit Society may not borrow from private sources without consent of Board.

14.—(1.) It shall be unlawful for any registered Credit Society which has contracted a loan or loans from the Board of Management under the provisions of this Ordinance to borrow from private sources without having first obtained the consent thereto of the Board of Management. Any member of the Committee of any Credit Society knowingly contravening this section shall be liable to a fine not exceeding £20.

(2.) The provisions of Clauses (*e*) and (*f*) of Section 13 of this Ordinance shall apply to all loans from private sources, and in giving the consent referred to in the preceding Sub-section the Board of Management shall have regard to, but shall not be bound by, the provisions of Clauses (*a*), (*b*) and (*d*) of Section 13 of this Ordinance.

Loans to be applied to agricultural purposes only.

15. It shall be unlawful for the Committee of any registered Credit Society that has obtained a loan from the Board of Management to allow any part of such loan to be applied to any purposes but those incidental to agriculture. Likewise it shall be unlawful for any member of any Registered Credit Society who has obtained a loan from such Society to apply any part of such loan to any purposes but those incidental to Agriculture. Any member of the Committee of any Credit Society and any member of any Credit Society knowingly contravening this section shall be liable to a fine not exceeding £20.

Registrar to be notified of details of loans, and of discharge of loans.

16. The full details of any loan made to any Credit Society shall within forty-eight hours of the loan being made be sent by the Committee of the Credit Society in a prepaid post letter addressed to the Registrar of Credit Societies, Port-of-Spain, for the purpose of being recorded in the Registrar's Office. The Committee shall likewise within forty-eight hours after the repayment of a loan forward to the Registrar's Office a certificate of the discharge of such loan. Such records shall be open to public inspection. Every member of the Committee of any Credit Society failing to carry out the provisions of this section shall be liable to a fine not exceeding £5.

GENERAL.

Duty of Warden and his officers to report.

17. The Board of Management or the Registrar may require any Warden to enquire into and report on any application under Section 4 hereof, or on the working of any registered Credit Society operating within his Ward, and it shall be the duty of the Warden and of his officers to take all steps necessary to enable such report to be made.

Auditor-General to report on Credit Societies.

18. The Auditor-General shall at least once a year investigate and report to the Governor regarding the organization and the administration of its business of every Credit Society registered under the provisions of this Ordinance, and shall, if required by the Governor in Executive Council, make a special investigation and report regarding any particular Credit Society specified by the Governor in Executive Council.

Governor in Executive Council may make regulations

19. The Governor in Executive Council shall have power to repeal, amend, or add to the regulations and rules set out in Schedules I and II and the forms set out in Schedules III, IV and V hereof.

No fees to be charged.

20. No instruments executed in pursuance of the provisions of this Ordinance or on account of any Credit Society registered under the provisions of this Ordinance shall be charged or chargeable with any fee or duty whatsoever, and no charge shall be made by the Registrar for certifying copies of any forms or agreements made under the provisions of this Ordinance.

Recovery of penalties.

21. All penalties under this Ordinance may be recovered before a Magistrate in the manner laid down in the Summary Conviction Offences (Procedure) Ordinance (No. 1).

Commencement.

22. This Ordinance shall commence on a day to be proclaimed by the Governor in the *Royal Gazette*.

Passed in Council this Tenth day of December, in the year of Our Lord One thousand nine hundred and fifteen.

J. M. FARFAN,
Acting Clerk of the Council.

Schedule I.

REGULATIONS AS TO ENQUIRIES BY REGISTRAR AND COMMITTEE.

1. Before registering any Agricultural Credit Society the Registrar shall with the assistance of the Committee appointed under the provisions of Section 6 of this Ordinance satisfy himself on the following points:—

(*a.*) That the Credit Society making application to be registered has been constituted in accordance with the rules contained in Schedule II or in any amendments thereof and that all the members of the Society have signed an agreement in terms of Schedule V.

(*b.*) That the application for Registration submitted by the Credit Society complies strictly with sections 4 and 7 of this Ordinance.

(*c.*) That the persons whose names are submitted as Trustees of the Credit Society are fit and proper persons to act as such:

(*d.*) That the person whose name is submitted as secretary has been duly elected with the general approval of the members at a general meeting of the Credit Society and that he is a fit and proper person to hold the position.

(*e.*) That each member of the Credit Society is the possessor of one paid up share in the Credit Society in a sum of not less than one dollar, and that each holds a good character and has a reputation for honesty, thrift, sobriety and diligence and is a fit and proper person to be a member of the Credit Society.

(*f.*) That the Treasurer is a fit and proper person.

2. In order to assist the Registrar and his Committee in coming to a conclusion on the foregoing matters, the Secretary of any Credit Society in making application for the registration of the Credit Society shall supply the following particulars in addition to the particulars required to be given under section 4 of this Ordinance. And all such particulars when supplied shall be regarded as private and confidential and shall not in any way be made public, except when necessary to the Governor in Executive Council or with the consent of the Trustees of a Credit Society to any person proposing to make a loan to such Credit Society:—

(*a.*) The business or calling of the Secretary and Treasurer and the amount of security that it is proposed that each should give.

(*b.*) The business or calling of each of the two Trustees and the amount of security that it is proposed that each should give.

(*c.*) The business or calling of each member of the Credit Society, and shewing whether each is an owner of land or a renter of land and the amount of land owned or rented in each case.

The above particulars as well as those required by section 4 of this Ordinance, shall be supplied on Form V set out in Schedule III.

3. The Registrar with his Committee shall in all cases be entitled to demand evidence of, and to inspect, the nature of the securities and satisfy himself of the solvency of Sureties, submitted for the due performance of the duties of those holding the offices of Treasurer, Secretary or Trustee of a Credit Society.

4. The Registrar assisted by his Committee shall in addition to the above advise and make recommendations in regard to any other matter relating to the carrying out of the provisions of this Ordinance, that may be referred to him by the Governor.

Schedule II.

RULES FOR THE GOVERNMENT OF AGRICULTURAL CREDIT SOCIETIES REGISTERED UNDER THIS ORDINANCE.

I.—NAME AND OBJECT OF THE CREDIT SOCIETY.

(a.) The Credit Society shall be called the " Agricultural Credit Society." Its registered Office is

(b.) Its object is to encourage thrift, self help and co-operation amongst agriculturists.

The great underlying principle of the Credit Society is *mutual co-operation and mutual liability* on the part of the members, borrowing and lending being confined to the members themselves, all of whom, belonging to one particular village or district and being well known to each other, are therefore mutually interested in the fulfilment of each other's engagements and obligations on which the success of the Credit Society entirely depends.

A great educational influence is desired to be exercised by the Credit Society in its insistence upon good character, upon proper investments, punctuality of repayment and by the instruction it gives as to the proper value of money.

(c.) Loans to members shall only be made on condition that the purpose for which money is borrowed is such that there is a sufficient prospect of the repayment of same by the production or business which it will enable the borrower to effect. The object of a Credit Society is not to furnish the entire or major part of a member's working capital but to supplement it.

II.—MEMBERSHIP.

(1.) The Credit Society shall consist of:—

(a.) Original members being owners or occupiers of land resident in the District of , who have united together to form the Credit Society.

(b.) Any person of good character, resident in the District of , who is an occupier or owner of land in the said district, and whose liability is not already pledged by membership in a similar association, who may be elected at a general meeting to be a member of the Credit Society on his application. Provided always that the total membership of the Society shall not at any time exceed fifty persons unless the Registrar shall in special cases permit a larger membership.

(2.) Any person desirous of becoming a member must fill up and sign a Form (see Form I, Schedule III) and forward the same to the Secretary.

(3.) Any member may retire after giving at least six months notice in writing of his intention so to do to the Secretary of the Credit Society and upon payment of all monies due by him to the Credit Society. Any member so retiring remains liable in respect to all loans made to the Credit Society during his membership so long as any part thereof or interest thereon remains unpaid.

(4.) The Committee of Management (vide Rule VI) shall have the power to exclude any member who may become insolvent, or be in arrears for unduly long periods with payments of share capital, of interest due or of capital borrowed or who may in any serious way impair the general interest or prestige of his Credit Society. Provided however that such member, after exclusion, shall continue to be responsible for any loans made to his Credit Society during the term of his membership.

III.—SHARES AND ENTRANCE FEES.

Every member on joining the Credit Society must hold a share; such share shall be not less than One Dollar, the amount and time for payment of same to be determined by the General Meeting of the Members of the Credit Society. Any person joining a Credit Society after its formation shall in addition to the aforesaid share pay an entrance fee of Fifty Cents. No dividend shall be payable upon such shares and entrance fees nor shall they be repaid to the members, such shares and entrance fees being deposited as a Reserve or Guarantee Fund. (Vide Rule XII.)

IV.—RIGHTS AND LIABILITIES OF MEMBERS.

(*a.*) Every Member of the Credit Society shall be entitled to obtain a loan from the Credit Society for specified and approved purposes in accordance with Rule X. Every member shall be entitled to attend the General Meetings in which the full powers of the Credit Society are vested to vote for the election of the Committee and certain officers and to claim all information required concerning the solvency and good management of the Credit Society, and to watch over the use to which money obtained on loan is put by members.

(*b.*) All monies payable by a Member to the Credit Society are deemed to be a debt due from such Member and are recoverable as such in any Court of competent jurisdiction.

(*c.*) If any claim on the Credit Society is made under Rule XI, which the Credit Society is unable to satisfy, or if a Member fails to repay any Loan and the Reserve Fund is not sufficient to meet the deficiency, an equal levy shall be made on every Member for the purpose of realising the amount required. The Members of the Credit Society are jointly and severally responsible as such for the payment of all monies borrowed by the Credit Society and may be sued in the Courts of Law for the same, but each Member of the Credit Society shall be liable only for Loans advanced to the Credit Society during his membership.

(*d.*) In the event of the death of a member, the liability of his heirs, executors and administrators shall extend only to such loans as may have been contracted with the Credit Society by him and which remain unpaid at his death, together with the interest thereon, and to such loans as may have been made to the Credit Society during his membership.

V.—GENERAL MEETINGS OF MEMBERS.

(*a.*) The first Meeting of Members shall have the same powers as are herein given to the Annual General Meeting.

(*b.*) An Annual General Meeting of the Members of the Credit Society shall be held in the month of August each year. At such Meeting, at which three quarters of the members of a Credit Society shall form a quorum, the Chairman of the Committee shall preside and shall present a Report and full Statement of accounts for the preceding year ending on the 30th June and the audited Balance Sheet, which it shall be the first business of the Meeting to consider, and if satisfactory, to approve. The Chairman shall also report upon the other transactions of the Committee. The meeting shall then decide any appeal referred to it against any decision of the Committee, brought by a member. The meeting shall then proceed to elect the Committee, Trustees, Auditors and a Treasurer and Secretary.

The members will also fix at each annual general meeting by resolution the total amount of savings deposits that may be accepted, the total amount of loans that may be contracted, the maximum of the total advances that any member of the Credit Society may hold at any one time during the ensuing year, the rate of interest to be charged on advances to members, the rate at which the Secretary may be remunerated, and when necessary the amount to be levied on each member in respect to such remuneration.

(c.) A Special General Meeting of members may be called at any time by the Committee; or on receipt of a demand signed by not less than one-fourth of the members stating their reasons for calling a Special General Meeting.

(*d.*) No member whatever his interest may be shall be entitled to more than one vote upon every matter submitted for consideration at any General Meeting.

VI.—THE COMMITTEE OF MANAGEMENT.

(*a.*) The Credit Society at its annual General Meeting, shall elect a Committee of Management, consisting of not fewer than five members, who shall be eligible for re-election on the expiry of their term of office. No member of the Committee nor any Office Bearer except the Secretary shall receive salary or any other remuneration under any conditions whatever.

(*b.*) *Duties of the Committee.*—The Committee shall elect its own Chairman who shall preside at the General and Committee Meetings of the Credit Society and who shall have in divisions, only one vote. The Committee shall meet as often as the necessary business of the Credit Society shall require; three to form a quorum. It shall arrange for at least two of its members to attend in rotation upon every occasion on which the registered office is open for the transaction of the business of the Credit Society.

(*c.*) It shall draw up a prospectus of the Credit Society, record the names of the Committee, Trustees, Treasurer, and Secretary; the Registered offices, the day and time of Ordinary Committee meetings, fix the interest and expense to be charged for Loans; and the terms and advantages offered to depositors.

It shall also have power to decide questions concerning (*a*) the purchase in common of farming requisites and (*b*) the sale in common of farm produce.

(*d.*) *The procedure of Ordinary Committee Meetings.*—The Secretary shall read the Minutes of the previous meeting. The Treasurer shall then present a Statement of Accounts showing the Loans outstanding, deposits on hand, and the amount of the Reserve Fund together with the number of members. This statement shall be checked and signed by the members of the Committee.

The Secretary shall then report as to the instalments or repayments due and unpaid, and the action to be taken in each case will thereupon be determined.

The Secretary shall then present any applications for Loans and the Committee will determine which can be granted.

Any special questions submitted for the consideration of the Committee shall then be discussed.

Special Duties of the Committee.—The Committee shall satisfy itself that all rules have been complied with; consider whether there has been any alteration in the status of any borrower or his sureties, if any, which would justify special action being taken for the termination of any Loan; appoint any person they think desirable in order to ascertain whether all Loans granted are being used for the purposes for which they were obtained.

The Committee shall direct the Secretary to supply all Returns required by the Registrar.

It shall also be the duty of the Committee to keep open at all times, a copy of the last annual balance sheet of the Credit Society for the time being together with the Report of the Auditors, for the inspection of the Members of the Credit Society, or of the Registrar or of any person appointed by him for that purpose.

Vacancies.—Any vacancy occurring on the Committee through death, resignation or removal, shall be filled at a Special General Meeting of the Credit Society which shall forthwith be summoned to elect a member to fill the vacancy. The Member so elected shall remain in office until the succeeding annual General Meeting and will then be eligible for re-election.

VII.—THE TRUSTEES.

The General Meeting shall elect two Trustees to hold the property of the Credit Society. The Trustees shall place any money belonging to the Credit Society not required for Loans on deposit in the Government Savings Bank or in any Incorporated Bank in the Colony. No Trustee shall receive any remuneration for services rendered.

Each Trustee shall give security in his own personal bond and in one solvent surety for the funds of the Credit Society in the possession of the Trustees, in such sum as the Committee of Management may decide is reasonable (*See* Form VI in Schedule III.)

VIII.—THE TREASURER.

The annual General Meeting shall elect a Treasurer who shall be approved by the Committee appointed under the provisions of Section 6 of this Ordinance. He shall receive from the Secretary all monies paid to him on behalf of the Credit Society. When the sum deposited with the Treasurer exceeds an amount fixed by the Committee of Management such excess shall be paid to the Trustees for deposit in the Government Savings Bank or any Incorporated Bank (*See* Rule VII). The Treasurer may also hold the position of Secretary. The office of Treasurer shall be purely an honorary one and he may or may not be a member of the Credit Society.

In the temporary absence of the Treasurer, the Committee shall appoint another person to perform his duties. Should his office become vacant for any cause whatsoever, a special General Meeting shall be called to elect another person in his stead.

The Treasurer shall give security in his own personal bond and in one solvent surety for the funds of the Credit Society in his possession, in such sum as the Committee of Management may decide is reasonable. (*See* Form VI, in Schedule III.)

IX.—The Secretary.

The annual General Meeting shall elect a Secretary. The duties of the Secretary shall be.—(*a*) To attend all the General meetings of the Credit Society, and all the meetings of the Committee of Management. (*b*) To keep a Register of names and addresses of all Members. (*c*) To supply Forms, Balance Sheets or other particulars required by Members. (*d*) To record Minutes of Meetings and the whole of the transactions of the Credit Society in the books provided. (*e*) To conduct all correspondence. (*f*) To receive and deposit with the Treasurer all monies received on behalf of the Credit Society. (*g*) To receive all applications for Loans or notice of withdrawals of Deposits and to bring the same before the Committee. (*h*) To prepare receipts and other documents in the form arranged for the signature of borrowers prior to their taking the Loans sanctioned. (*i*) To pay to members or others amounts authorized to be paid by the Committee.

In addition to these general duties, the Secretary shall prepare the annual Financial Return and Balance sheet and shall attend upon the Auditors when making the audit, producing for their inspection vouchers for all payments which have been made on behalf of the Credit Society.

The Secretary may be the Treasurer also, and may, unless he is a paid Secretary, be a member of the Credit Society.

In the temporary absence of the Secretary, the Committee may appoint another person to perform his duties. The Committee may immediately suspend or dismiss the Secretary for any irregularity in the performance of his duties. On receiving notice of suspension or dismissal, the Secretary shall have the right of appeal to a Special General Meeting which, upon his request, must be convened.

The Committee may appoint another person to act for a suspended or dismissed Secretary until his appeal, if any, has been disposed of; and in the event of a vacancy in the office of Secretary for any cause whatsoever, may appoint another person to act as Secretary until the next Annual General Meeting.

The duties of the Secretary may be shared with certain members of the Committee, if so approved by the Committee, or the Committee may sanction the employment of a clerical assistant for some of the work above mentioned, and in this case the expenses of such assistant shall be defrayed from the funds of the Credit Society as the Committee may determine, but such assistant shall not be a member of the Credit Society, nor entitled to borrow any of the Funds of the Credit Society.

The Secretary shall give security in his own personal bond and in one solvent surety in such sum as the Committee of Management may decide is reasonable, for the funds of the Credit Society which will in the course of business pass through his hands. (*See* Form VI in Schedule III.)

The Secretary may be remunerated at a rate to be determined by the members at a general meeting. The funds for payment of such remuneration may if necessary with the consent of a general meeting be obtained by equal levy on all the members of the Credit Society.

X.—LOANS.

(*a.*) Applications for loans shall be forwarded to the Secretary on the prescribed forms and shall be considered by the Committee. Loans, when approved by the Committee shall be granted to members who are able to obtain either one or two sureties as may be approved by the Committee or who can give such security as the Committee may deem sufficient. No member who is in possession of money lent to him by the Credit Society shall be accepted as surety for another member requiring a loan unless the members of the Committee are unanimous that it is safe to accept him.

(*b.*) Members who desire to obtain a Loan shall fill up a form (*see* Form II, in Schedule III.) stating the amount required, the object for which it is required, the term for which it is asked, whether it is desired to repay the Loan by instalments, with the security offered.

(*c.*) If the Committee are satisfied with the trustworthiness of the applicant, the sufficiency of the security offered, the profit by production or saving which the use of the Loan may effect, and if they have sufficient funds under their control, they may sanction the Loan.

(*d.*) No Loan shall be granted to any person who is not a registered member of the Credit Society.

(*e.*) If the Committee decide that the Loan cannot be granted from lack of funds or aught else, or if they think proper to postpone the consideration of any application, the Secretary shall notify the applicant to that effect.

(*f.*) If the Loan is repayable by instalments, prompt payment must be made and no excuse accepted for non-payment.

Any want of faithful compliance shall render the borrower liable to have his full Loan immediately recalled. Where sickness or other sufficient cause is duly notified to the Secretary before an instalment is due, the Committee may extend the time for repayment of an instalment.

(*g.*) The interest to be charged on Loans shall in no case exceed twelve per centum per annum. The interest shall be payable at the time the Committee determine, but in no case later than the same date as the Loan is repayable.

(*h.*) When a Loan is sanctioned, the borrower shall be notified to that effect by the Secretary, and if the borrower does not consent to take the Loan on the terms offered by the Committee within one week from the date upon which assent is given, the Committee shall not be held bound to complete the Loan. If the borrower consents to accept the terms offered, then before the amount be advanced the borrower and his sureties, if any, shall execute a promissory note or a declaration as to possession of effects free from encumbrance or any other document which the Committee may consider necessary, and the borrower shall also enter into an agreement as to the terms of repayment (*see* Form III, Schedule III.)

(*i.*) If the Loan be repayable by instalments the borrower shall be supplied with a card (*see* Form IV, Schedule III) or book upon or in which shall be stated the amount and the terms of advance and upon or in which the instalments when repaid shall be entered and initialled by the official to whom the money is paid.

(*j.*) If any member shall be found to have misapplied a Loan, the Committee shall have power to recall the Loan immediately.

(*k.*) If a member of the Committee be an applicant for a Loan he must withdraw from the Meeting of the Committee while such application is under consideration. No Loan shall be granted to any member whose credit is pledged in any other Agricultural Credit Society.

XI.—BORROWING POWERS.

The Credit Society shall have power to receive deposits or borrow capital on the security of all the Members, jointly and severally, but whenever such action is taken, a majority vote of three-fourths of all the Members present at a General Meeting of the Credit Society called for the purpose must be obtained, inasmuch as responsibility of repayment descends to each and every member to the last, and every member is liable to be sued for repayment of the same.

Should the Credit Society however have contracted a Loan or Loans from the Board of Management, it shall not be lawful for the Credit Society to borrow in addition from private sources without having first obtained the consent thereto of the Board. (*Vide* Section 14 of this Ordinance.)

XII.—RESERVE FUND AND EXPENSES OF MANAGEMENT.

A Reserve Fund shall be formed to serve as cover for any loss as shown by the balance sheet, and shall be credited with at least ten per cent. of the annual net profits, in addition to the shares and entrance fees referred to in Rule III. The Reserve Fund should be brought up to the amount of 20 per cent. of the total working capital as shown in the balance sheet, if possible.

In the event of its being necessary to draw upon the Reserve Fund it should as soon as possible again be brought up to the above limit.

In no case shall the Reserve Fund be divided, and should the Credit Society be dissolved it shall be devoted to some useful public purpose in the Ward in which the Credit Society operated, and determined upon by the meeting at which the dissolution of the Credit Society takes place.

Any sums to the credit of the Reserve Fund shall be placed on deposit by the Trustees in the Government Savings Bank or any Incorporated Bank in the Colony.

No profit, bonus or dividend of any kind shall be divided among the Members.

If the income derived in any one year from sources other than shares and entrance fees prove insufficient to meet the expenses of management, then the annual general meeting may order a levy on the members or vote such sum as it may think desirable from the Reserve Fund to meet the deficiency subject to the above limitation.

XIII.—ACCOUNTS AND BOOK-KEEPING.

(*a.*) In the books of the Credit Society provision shall be made for keeping;

1. The minutes of all Meetings.
2. A Register of names and addresses of all Members.

3. Particulars of applications for Loans, and dates on which repayments were made.
4. A Cash book in which all amounts received or paid for any purpose shall be entered.
5. Accounts as required by the Auditors, in which shall be posted all entries from the Cash Book.

(*b*.) An Annual Financial Return shall be prepared each year showing Receipts and Expenditure for the preceding year; and a Balance Sheet drawn up showing the Funds and Effects of the Credit Society and its liabilities to date.

(*c*.) The books and accounts shall be open to the inspection of any Member of the Credit Society, at all times of Meeting, or when the Registered Office is open for the transaction of the Credit Society's business.

XIV.—AUDIT OF ACCOUNTS.

(*a*.) The Committee of Management shall once at least in every six months submit the accounts, together with a general statement of the same, and all necessary vouchers, books, documents, cash in hand or other goods belonging to the Credit Society for audit, to two or more persons appointed as auditors by the members at the Annual General Meeting each year, and in addition shall give all facilities for inspection and investigation by an officer of the Audit Department as provided for by Section 18 of this Ordinance and shall lay before every such meeting a balance sheet showing the receipts and expenditure, funds and effects of the Credit Society, together with a statement of the affairs of the Credit Society since the last ordinary meeting, and of their then condition. Such auditors shall have access to all the books and accounts of the Credit Society, and shall examine every balance sheet and Annual Return of the receipts and expenditure, funds and effects of the Credit Society, and shall verify the same with the accounts and vouchers relating thereto, and shall either sign the same as found by them to be correct, duly vouched, and in accordance with law, or shall specially report to the meeting of the Credit Society before which the same is laid, in what respects they find it incorrect, unvouched or not in accordance with law.

(*b*.) A copy of the Annual Balance Sheet of the Credit Society, duly certified by such auditors, shall be forwarded to the Registrar as soon as possible after the completion of the same.

XV.—SETTLEMENT OF DISPUTES.

Any dispute arising between a member or person claiming through a member, or under the rules, and the Credit Society, or the Committee, or any officer thereof, may be brought before a General Meeting of the members, whose decision shall be final.

XVI.—DISSOLUTION OF THE SOCIETY.

The Credit Society may at any time be dissolved by the consent of five-sixths of the members, testified by their signatures to an instrument of dissolution.

Such instrument of dissolution shall be forwarded forthwith by the Secretary to the Registrar, who shall cause a note thereof to be made in his Register of Credit Societies.

Schedule III.

FORM I.

FORM OF APPLICATION FOR MEMBERSHIP.

To the

AGRICULTURAL CREDIT SOCIETY.

191

I the undersigned, hereby apply to be admitted a member of the above-named Credit Society, and if accepted, agree to be bound by and observe all the Rules and Regulations of the Credit Society.

Signature of Applicant
(*in full.*)
Occupation
Address

Admitted a member of the above-named Credit Society this day of 191

Chairman.
Secretary.

FORM II.

APPLICATION FOR LOAN.

I being a member of the Agricultural Credit Society hereby make application for a Loan of $ subject to the rules of the Credit Society.

1. * The Loan is to be repayable on the day of 191 . with interest at % *or* The Loan with interest thereon at % to be repayable by instalments of $ on the day of and the day of

2. The purpose for which I require the Loan is

3. The Security I am prepared to offer is

Signature
Address
Occupation

Date 191

NOTICE APPROVING APPLICATION FOR LOAN.

To Mr.

NOTICE IS HEREBY GIVEN that the Committee of the AGRICULTURAL CREDIT SOCIETY, have decided to grant you a Loan of Dollars upon the terms and conditions specified in your application of the day of 191

For THE AGRICULTURAL CREDIT SOCIETY.

Chairman.
Secretary.

191

**Cross out the part of this paragraph inapplicable.*

FORM III.

AGREEMENT FOR LOAN FOR A TERM.

An Agreement made this day of , One thousand nine hundred and between The Agricultural Credit Society being a Credit Society duly registered under the Agricultural Credit Societies Ordinance 1915 and having its Registered Office at in the Island of hereinafter called the "Credit Society" of the one part and hereinafter called "the Borrower" of the other part.

Witnesseth that in consideration of the sum of this day lent to the Borrower (the receipt whereof is hereby acknowledged) he the said borrower hereby agrees—

(1.) *That he will repay the said sum of with interest at the rate of per cent. per annum on the day of next, *or* that he wlll repay the said sum with interest thereon at % by instalments of $ on the day of 19 , and the day of 191 .

(2.) That he will employ the said sum of dollars for the purpose of and will furnish the Credit Society or its representatives with such proof thereof as they may reasonably require.

(3.) That he will be bound by and observe all the Rules and Regulations of the Credit Society for the time being in force.

(4.) That in the event of the non-performance or non-observance of all or any of the terms and conditions on the part of the Borrower herein contained and hereby agreed to be performed and observed the said sum of dollars or such part thereof as shall remain unpaid with interest as aforesaid shall immediately become due and payable and if not paid upon demand shall be recoverable from the Borrower as a debt.

As Witness the hands of the parties the day and year first above written.

Signature of Borrower:
Address:
Occupation:
Witness to Signature of Borrower:
Signature of Secretary at the direction of Committee :

The undersigned of and of bind $\frac{\text{themselves}}{\text{himself}}$ as $\frac{\text{Sureties}}{\text{Surety}}$ for the above-named debt not only for interest but as joint and several debtors of the Agricultural Credit Society until the complete redemption of the same, also for any period of extension and expressly declare that $\frac{\text{they}}{\text{he}}$ renounce any defence by which $\frac{\text{they}}{\text{he}}$ may void $\frac{\text{their}}{\text{his}}$ liability.

Witness Signature.
Date Witness Signature.

Seen and noted for payment according to the decision of the Committee of Management this day of 191 .

Chairman.

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* *Cross out the part of this paragraph inapplicable.*

FORM IV.

LOAN REPAYMENT CARD.

AGRICULTURAL CREDIT SOCIETY.

LOAN REPAYMENT CARD.

Registered Office :

Hours :

OFFICERS :

Date.	Amount. $	c.	Secretary's Initials.
Brought forward			

Name of Borrower :
Address :
Amount $ *Date granted :*
Term of Loan :
How to be repaid :
Date when to be completed : *191*

Date.	Amount. $	c.	Secretary's Initials.
Carried forward			

OBJECTS OF THE CREDIT SOCIETY.

To assist members by Loans of money at a moderate rate of interest and to raise money for this purpose on the combined security of all the Members of the Credit Society.

CONDITIONS OF BORROWING.

That the borrowers shall be persons of good character.

That they shall be owners or occupiers of land and shall live in the district in which the Credit Society operates.

That they shall apply the money borrowed for a specific purpose sanctioned by the Committee.

That they shall give such security as the Committee may consider necessary.

That they shall be bound by the Rules and Regulations of the Credit Society.

FORM V.

APPLICATION FOR THE REGISTRATION OF THE AGRICULTURAL CREDIT SOCIETY FORMED UNDER THE AGRICULTURAL CREDIT SOCIETIES ORDINANCE, 1915.

To the Registrar of Agricultural Credit Societies, Port-of-Spain.

I of do declare that I was duly elected Secretary of the Agricultural Credit Society at a general meeting of the said Credit Society held on the day of 191 , and that I have been authorized by the said Credit Society at a general meeting, to make application for the registration of the Credit Society under Section 9 of the said Ordinance.

2. I enclose order for one dollar as registration fee.

I enclose the signed Articles of Association of the Credit Society (Schedule V)

I append also the particulars required by Section 4 of the said Ordinance and by Regulation 2 of the Regulations in Schedule I hereof.

PARTICULARS OF THE AGRICULTURAL CREDIT SOCIETY.

1. Office or place of business of the Credit Society. ______
2. Names and addresses of the Members of the Committee. ______
3. Name and address of Secretary. ______
4. Business or calling of Secretary. ______
5. Amount of security bond to be given by Secretary. ______
6. Name and address of Secretary's Surety. ______
7. Name and address of Treasurer. ______
8. Business or calling of Treasurer. ______
9. Amount of security bond to be given by Treasurer. ______
10. Name and address of Treasurer's Surety. ______

Schedule IV.

AGREEMENT FOR REPAYMENT OF LOAN MADE TO A CREDIT SOCIETY.

WHEREAS for the purpose of assisting an Agricultural Credit Society known as the Agricultural Credit Society which Credit Society has been duly registered under the provisions of "The Agricultural Credit Societies Ordinance, 1915," (hereinafter called the lender), has agreed to advance the sum of to the Trustees and Members of the Credit Society by way of loan upon the joint and several liability of the said Trustees and Members.

Now this agreement witnesseth that in consideration of a loan of made to of and of , the Trustees of the said Credit Society, the receipt of which the said Trustees do hereby acknowledge the said and as such Trustees acting on behalf of themselves and all the Members of the said Credit Society do hereby jointly and severally agree that they will on the day of 191 , repay to the lender the sum of with interest thereon at per centum per annum.

Signed on behalf of the Agricultural Credit Society.

} Trustees.

Witness

Witness

Schedule V.

ARTICLES OF ASSOCIATION OF THE AGRICULTURAL CREDIT SOCIETY REGISTERED UNDER THE AGRICULTURAL CREDIT SOCIETIES ORDINANCE, 1915, ON THE DAY OF 191 .

WE the undersigned agree to become members of the Agricultural Credit Society and by virtue of our Signatures hereto appended we agree to be bound and to abide by all rules that have been made, or that may in the future be passed by the Governor in Executive Council, for the Government of Agricultural Credit Societies registered under the Agricultural Credit Societies Ordinance, 1915, or under any Ordinance amending the same.

We further hereby acknowledge our joint individual unlimited liability for all loans contracted on behalf of the Credit Society by the Trustees with the consent of a general meeting of the Credit Society and also for all deposits that may be made in accordance with the rules referred to above.

Date of signing Articles.	*Witness to Signature.*	*Signature of Member.*
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NOTE.—(1.) Each member must sign two copies of this document.

(2.) One copy to be lodged with the Registrar and one copy in the office of the Credit Society.

(3.) Any new member joining must sign both copies.

(4.) A copy of the rules must be attached to each copy of the Articles o Association.

COCONUTS.

ANURIAL EXPERIMENTS ON COCONUTS 1914-15.

BY JOSEPH DE VERTEUIL, F.C.S.,
Superintendent of Field Experiments.

THIS report deals with the fourth year's results of the manurial periments on coconuts, under the control of the Board of Agriculture d is in continuation of the reports for 1911-12, (1) 1912-13 (2) and 13-14. (3)

As in previous years the yield for 1911-12 is taken as the "natural ield" for each plot, owing to the fact that the manures had only been pplied shortly before. This year's yield may therefore be compared with at of 1911-12, but it is not advisable to draw conclusions from the sults of a single year.

The figures obtained are given in Tables I to VI for each estate spectively. In these tables the heading "value of probable increase or ecrease due to manuring" may require some explanation. The probable crease or decrease due to manuring is the increase or decrease of the anured plots to which is added or deducted the decrease or increase shown y the average of the control plots. When the control plots show an increase is probable that the manured plots show a larger increase than what is ctually due to manuring and the natural increase indicated by the control lots must be deducted to arrive at correct results. The writer is erfectly aware that all the plots will not, under uniform conditions, show e same increase or decrease each year, but if the average be taken over series of years the error will be greatly reduced.

"Decrease due to manuring" means that the cost of the manures and f their application is greater than the value of the increased yield btained.

Throughout this report control plots mean the *average* for the control lots.

In calculating the yield and cost of manuring per acre, it has been ssumed that there are 75 trees to the acre, as the trees are planted 24 feet part. The price of "selects"(4) has been fixed at $25.00 and that of 'culls" at $15.00 per 1,000.

The net pecuniary results of the experiments for this and previous ears are shown graphically in diagrams I to III for each estate espectively.

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(1) *Bulletin, Department of Agriculture.* XI, 1912, 179-84.

(2) *Ibid* XIII, 1914, 1-7.

(3) *Ibid* XIII, 1914, 267-76.

(4) "Selects" or "Standard" nuts are those which when husked do not pass hrough a ring 3¾ inches in diameter and are otherwise sound. "Culls" are sound uts measuring between 3 and 3¾ inches in diameter.

EXPLANATION OF DIAGRAM.

The plots are indicated by the numbers 1, 2, 4, &c.

Each distance from 0 to 10, 10 to 20, &c., represents ten (10) dollars and therefore the space from any one horizontal line to the next is equivalent to one (1) dollar.

The returns of the control plots in each series, indicated by the dotted red lines at 0, has been taken as the base line, and the result for each of the other plots calculated in the following manner. From the increase or decrease in value of the nuts on a manured plot over the same plot in the first year of the experiment has been added or deducted the decrease or increase in the yield on the control plots during the same period, and the result is taken as indicating the difference in the manured plots due to manuring. For example, plot 1 in Table I, Morvant Estate, shows an increase over crop 1911-12 valued at $8.56 and the control plots an increase of $11.17, the value of the probable increase due to manuring is therefore $8.56 – $11.17 or a loss of $2.61.

From this is deducted the cost of manuring; the result indicates the gain or loss on manuring. Thus – $2.61 less $4.07 = a loss of $6.68.

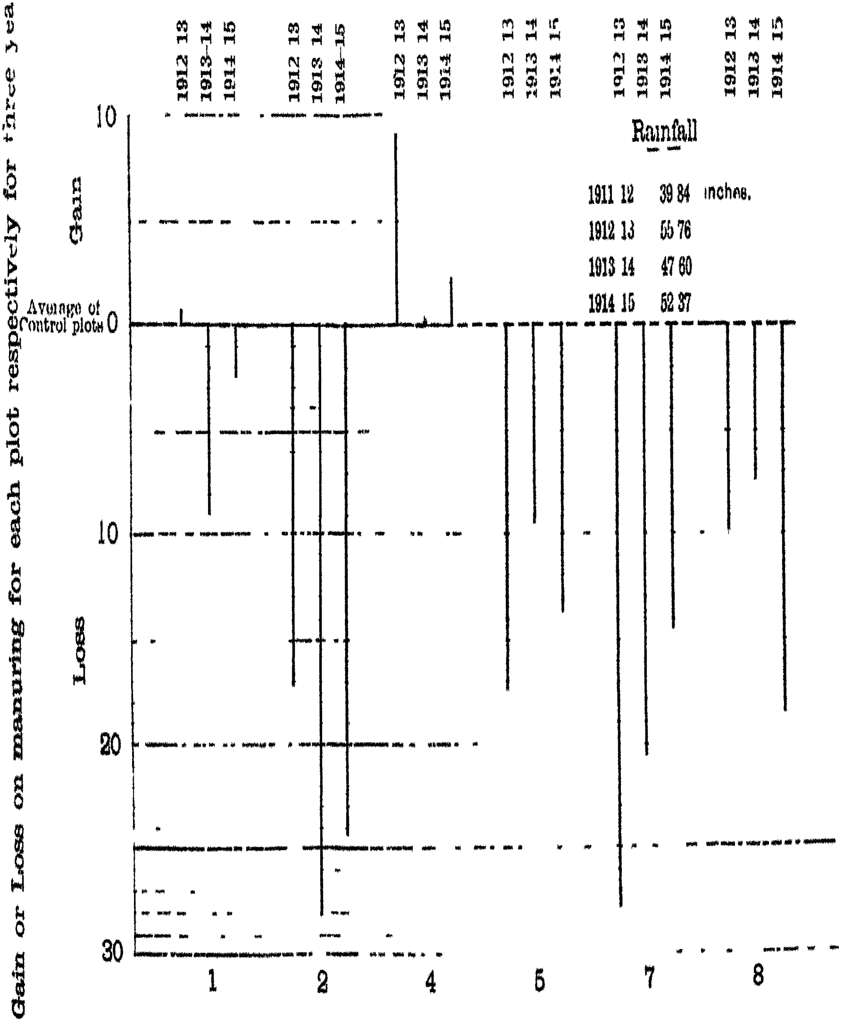
This value is plotted to scale, above the base line when the result on manuring has been a gain and below it when a loss.

The diagram thus indicates the general monetary results for each plot in each experiment and renders it easily possible to compare results throughout the set of experiments. For the detailed figures, and such important points as the relative proportion of "selects" and "culls" the tables themselves should be consulted.

Diagram II. - Beaulieu Estate, Cedros.

Average of series A B and C

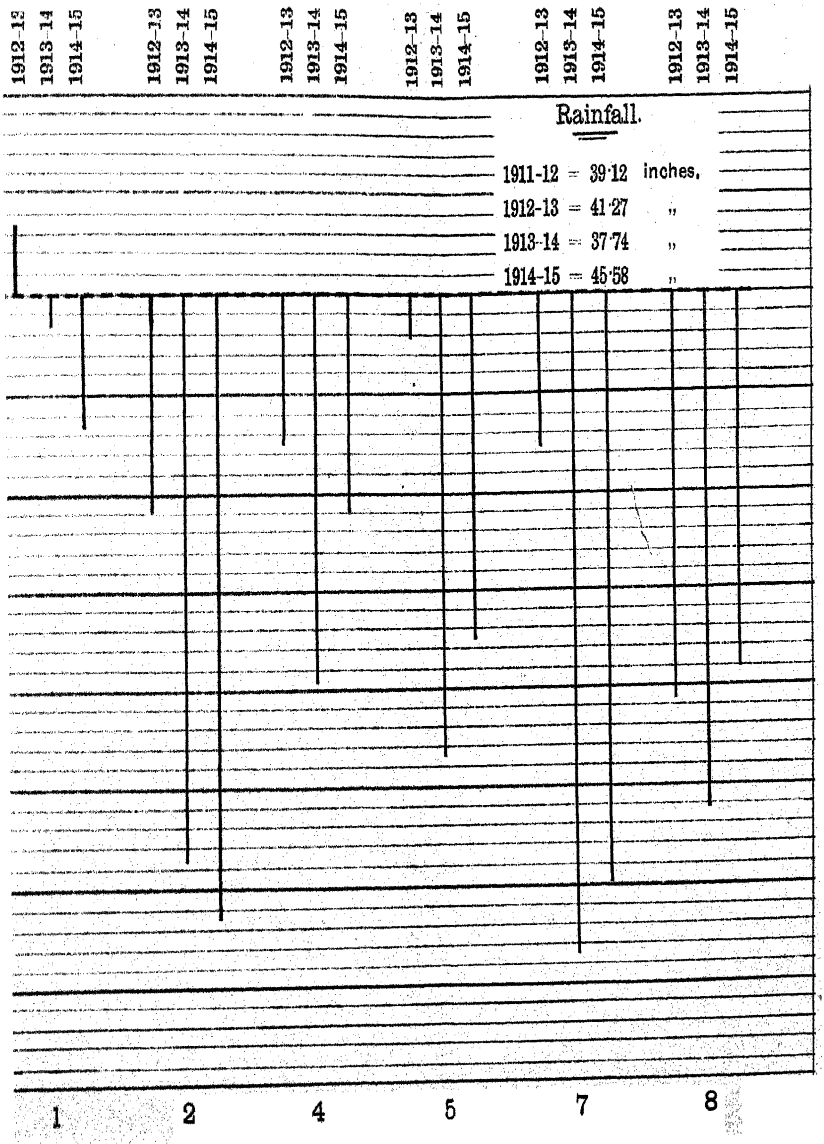
Showing net pecuniary results per acre



Explanation of Diagram - *Vide* page 57.

Diagram I.—Morvant Estate, Laventille.

Showing net pecuniary results per acre.



Explanation of Diagram—*Vide* page 57.

MORVANT ESTATE—LAVENTILLE.

The fourth application of manures was made in May, 1914. Before spreading the manures the soil around the trees was lightly forked.

	Inches.
Rainfall, July 1 to June 30...	1911-12 = 39·12 1912-13 = 41·27 1913-14 = 37·74 1914-15 = 45·58

TABLE I.—MANURIAL EXPERIMENTS.—MORVANT ESTATE, LAVENTILLE.

Trees about 25 years old in 1911.

lot.	No. of bearing trees.	Manures applied per tree *each year from 1911.*	Crop July 1, to June 30.	Average number of nuts picked per tree.	Per cent. Selects.	PER ACRE.					
						Selects.	Culls.	Value of increase or decrease on crop 1911-12.	Value of probable increase or decrease due to manuring.	Cost of manuring.	Gain or loss on average of *no manure* plots.
								$ c.	$ c.	$ c.	$ c.
1	67	4 lb. Lime ... 4 ,, Kainit ...	1911-12	20·3	58·9	899	627				
			1914-15	26·9	50·7	1,022	993	+ 8.56	- 2.61	4.07	- 6.68
2	70	6 lb. Basic slag 1 ,, Sulphate of potash	1911-12	38·9	63·7	1,857	1,059				
			1914-15	29·9	65·7	1,472	769	- 13.97	- 25.14	6.21	- 31.35
3	**67**	**Control — No manure**	**1911-12**	**40·7**	**58·5**						
			1914-15	**48·2**	**38·2**						
4	66	4 lb. Basic slag 2 ,, Nitrate of soda	1911-12	35·1	65·2	1,719	917				
			1914-15	41·1	58·5	1,801	1,278	+ 7.46	- 3.71	7.26	- 10.97
5	69	2 lb. Calcium cyanamide 2 ,, Sulphate of potash	1911-12	43·8	61·1	2,006	1,278				
			1914-15	44·7	62·4	2,093	1,261	+ 1.92	- 9.25	8.34	- 17.59
6	**69**	**Control — No manure**	**1911-12**	**25·9**	**64·9**						
			1914-15	**38·6**	**57·3**						
	69	2 lb. Bone meal 1 ,, Sulph. of ammonia 150 ,, Pen manure	1911-12	41·0	60·8	1,872	1,207				
			1914-15	36·9	65·7	1,818	949	- 5.22	- 16.39	13.66	- 30.05
	70	2 lb. Dissolved bones 1 ,, Sulphate of potash 150 ,, Pen manure	1911-12	31·1	61·9	1,443	889				
			1914-15	35·4	53·6	1,425	1,233	+ 4.71	- 6.46	12.71	- 19.17
		Average of Control plots ...	**1911-12**	**33·0**	**61·0**	**1,525**	**975**				
			1914-15	**43·3**	**46·8**	**1,520**	**1,728**	**+ 11.17**			

All the plots, except plots 2 and 7 have given an increased yield compared with op 1911-12 but none of the plots has given a larger increase than the control plots.

The percentage of selects has increased for plots 2, 5 and 7 respectively compared ith crop 1911-12, but the decrease for plots 1, 4 and 8 is less than that from the ntrol plots.

When, however, the value of the probable increase for each plot is calculated and e cost of manuring deducted as shown in diagram I none of the plots show gain.

BEAULIEU ESTATE—CEDROS.

These experiments are being conducted in three series A, B and C as shown in tables II to IV. The average results for the three series are given in table V.

The manures were applied in April, 1914, but the land was not forked.

		Inches.
Rainfall, July 1, to June 30	1911-12	= 39·84
	1912-13	= 55·76
	1913-14	= 47·60
	1914-15	= 52·37

TABLE II.—MANURIAL EXPERIMENTS.—BEAULIEU ESTATE, CEDROS.—SERIES A.

Trees 30 to 35 years old in 1911.

Plot.	No. of bearing trees.	Manures applied per tree *each year from 1911.*	Crop July 1, to June 30.	Average number of nuts picked per tree.	Per cent. Selects.	PER ACRE.					
						Selects.	Culls.	Value of increase or decrease on crop 1911-12.	Value of probable increase or decrease due to manuring.	Cost of manuring.	Gain or loss on average of *no manure* plots.
								$ c.	$ c.	$ c.	$ c.
1	16	4 lb. Lime	1911-12	135·9	40·2	4,096	6,094				
		4 ,, Kainit	1914-15	77·7	15·2	885	4,941	-97.57	+9.18	4.51	+4.67
2	16	6 lb. Basic slag	1911-12	107·4	58·3	4,695	3,358				
		1 ,, Sulphate of potash	1914-15	63·8	23·7	1,134	3,652	-84.61	+22.14	6.65	+15.49
3	14	**Control — No manure.**	**1911-12**	**120·8**	**46·3**	...	...	...	...	...	...
			1914-15	**62·4**	**17·5**	...	...	...	..	...	..
4	14	4 lb. Basic slag	1911-12	135·1	58·2	5,896	4,234				
		2 ,, Nitrate of soda	1914-15	80·9	25·2	1,530	4,540	-104.56	+2.19	7.70	-5.51
5	15	2 lb. Calcium cyanamide	1911-12	138·9	45·6	4,751	5,669				
		2 ,, Sulphate of potash	1914-15	84·1	20·3	1,281	5,029	-96.35	+10.40	8.78	+1.62
6	15	**Control — No manure.**	**1911-12**	**146·8**	**65·6**	...	...	...	...	...	...
			1914-15	**96·4**	**21·3**	...	..	...	...	...	...
7	15	2 lb. Bone meal	1911-12	126·4	54·8	5,195	4,285				
		1 ,, Sulph. of ammonia 150 ,, Pen manure	1914-15	89·9	26·8	1,806	4,934	-74.99	+31.76	13.85	+17.91
8	17	2 lb. Dissolved bones	1911-12	125·3	59·4	5,584	3,816				
		1 ,, Sulphate of potash 150 ,, Pen manure	1914-15	88·0	25·4	1,677	4,927	-81.01	+25.74	12.91	+12.83
		Average of Control plots ...	**1911-12**	**134·3**	**57·2**	**5,761**	**4,311**	...	...	...	...
			1914-15	**80·0**	**19·9**	**1,194**	**4,806**	**-106.75**	...	...	...

TABLE III.—MANURIAL EXPERIMENTS, BEAULIEU ESTATE, CEDROS.—SERIES B.

Trees 30 to 35 years old in 1911.

Plot.	No. of bearing trees.	Manures applied per tree *each year from 1911.*	Crop July 1, to June 30.	Average number of nuts picked per tree.	Per cent. Selects.	PER ACRE.					
						Selects	Culls	Value of increase or decrease on crop 1911-1912.	Value of probable increase or decrease due to manuring.	Cost of manuring	Gain or loss on average of *no manure* plots.
								$ c.	$ c.	$ c.	$ c.
1	19	4 lb. Lime 4 ,, Kainit	1911-12	83·0	60·9	3,791	2,434				
			1914-15	74·6	31·4	1,757	3,840	- 29.76	- 19.36	4.51	- 23.87
2	27	6 lb. Basic slag 1 ,, Sulphate of potash	1911-12	70·0	78·1	4,100	1,150				
			1914-15	55·4	32·1	1,335	2,823	- 44.03	- 33.63	6.65	- 40.28
3	29	Control — No manure	1911-12	50·1	70·9						
			1914-15	62·5	21·4						
4	25	4 lb. Basic slag 2 ,, Nitrate of soda	1911-12	54·9	67·7	2,788	1,331				
			1914-15	62·7	27·4	1,288	3,413	- 6.27	+ 4.13	7.70	- 3.57
5	25	2lb. Calcium cyanamide 2 ,, Sulphate of potash	1911-12	61·7	65·3	3,024	1,607				
			1914-15	69·0	30·5	1,578	3,597	- 6.30	+ 4.10	8.78	- 4.68
6	23	Control — No manure	1911-12	65·3	51·1						
			1914-15	62·0	21·0						
7	27	2 lb. Bone meal 1 ,, Sulph. of ammonia 150 ,, Pen manure	1911-12	56·1	54·4	2,291	1,920				
			1914-15	57·5	23·3	1,006	3,311	- 11.26	- 0.86	13.85	- 14.71
8	28	2 lb. Dissolved bones 1 ,, Sulphate of potash 150 ,, Pen manure	1911-12	57·3	59·3	2,549	1,749				
			1914-15	57·6	16·4	708	3,612	- 18.08	- 7.68	12.91	- 20.59
		Average of Control plots	1911-12	57·4	60·1	2,586	1,717				
			1914-15	62·3	21·2	991	3,682	- 10.40			

TABLE IV.—MANURIAL EXPERIMENTS.—BEAULIEU ESTATE, CEDROS.—SERIES C.

Trees 30 to 35 years old in 1911.

Plot.	No. of bearing trees.	Manures applied per tree. *each year from 1911.*	Crop July 1, to June 30.	Average number of nuts picked per tree.	Per cent. Selects.	Per Acre.					
						Selects.	Culls.	Value of increase or decrease on crop 1911–12.	Value of probable increase or decrease due to manuring.	Cost of manuring.	Gain or loss on average of *no manure* plots.
								$ c.	$ c.	.	$ c.
1	26	4 lb. Lime ...	1911–12	55·8	55·9	2,339	1,846				
		4 „ Kainit ...	1914–15	60·2	21·3	961	3,553	- 8.84	+ 21.54	4.51	+17·03
2	24	6 lb. Basic slag	1911–12	82·1	59·9	3,701	2,480				
		1 „ Sulphate of potash	1914–15	59·1	28·0	1,241	3,193	- 50.88	- 20.50	6.65	- 27.15
3	27	**Control — No manure**	**1911–12**	**59·0**	**57·1**						
			1914–15	**52·0**	**23·4**						
4	25	4 lb. Basic slag	1911–12	63·9	49·8	2,389	2,408				
		2 „ Nitrate of soda	1914–15	67·6	16·6	842	4,228	- 11.37	+ 19.01	7.70	+ 11.31
5	16	2 lb. Calcium cyanamide	1911–12	103·3	57·7	4,472	3,279				
		2 „ Sulphate of potash	1914–15	82·0	21·8	1,341	4,809	- 55.32	- 24.94	8.78	- 33.72
6	19	**Control — No manure**	**1911–12**	**77·6**	**54·1**						
			1914–15	**61·4**	**28·6**						
7	17	2 lb. Bone meal 1 „ Sulph. of ammonia	1911–12	101·9	49·4	3,777	3,869				
		150 „ Pen manure	1914 15	82·4	13·8	853	5,332	- 51.15	- 20.77	13.85	- 34.63
8	19	2 lb. Dissolved bones 1 „ Sulphate of potash	1911–12	98·7	50·9	3,768	3,634				
		150 „ Pen manure	1914–15	65·5	27·6	1,355	3,555	- 61.51	- 31.13	12.91	- 44.04
		Average of Control plots	**1911–12**	**67·5**	**55·5**	**2,809**	**2,252**				
			1914–15	**55·9**	**25·7**	**1,077**	**3,113**	**- 30.38**			

TABLE V.—MANURIAL EXPERIMENTS.—BEAULIEU ESTATE, CEDROS.

Average of Series A, B and C.

Plot.	Crop July 1, to June 30.	Average number of nuts picked per tree.	Per cent. Selects.	Per Acre.					
				Selects.	Culls.	Value of increase or decrease on crop 1911-12.	Value of probable increase or decrease due to manuring.	Cost of manuring.	Gain or loss on average of *no manure* plots.
						$ c.	$ c.	$ c.	$ c.
1	1911-12	84·4	51·3	3,248	3,083				
	1914-15	69·3	22·9	1,190	4,006	- 37.60	+ 1.93	4.51	- 2.58
2	1911-12	84·2	64·9	4,100	2,218				
	1914-15	58·8	28·4	1,251	3,156	- 57.15	- 17.62	6.65	- 24.27
3	**1911-12**	**68·4**	**57·1**						
	1914-15	**58·4**	**21·3**						
4	1911-12	75·7	58·6	3,327	2,351				
	1914-15	68·6	22·7	1,168	3,976	- 29.60	+9.93	7.70	+ 2.23
5	1911-12	94·2	55·4	3,916	3,153				
	1914-15	76·8	24·9	1,433	4,324	- 44.51	- 4.98	8.78	-13.76
6	**1911-12**	**89·6**	**57·9**						
	1914-15	**70·8**	**23·3**						
7	1911-12	88·0	52·8	3,484	3,115				
	1914-15	72·9	21·3	1,165	4,306	- 40.11	- 0.58	13.85	- 14.43
8	1911-12	86·2	56·3	3,639	2,825				
	1914-15	68·0	22·7	1,158	3,944	- 45.24	- 5.71	12.91	- 18.62
Average of Control plots.	**1911-12**	**78·6**	**57·5**	**3.388**	**2,504**				
	1914-15	**64·0**	**22·3**	**1.071**	**3,730**	**- 39.53**			

From the above table it will be seen that all of the plots have given a smaller yield than in 1911-12, and that the decrease from plot 4 alone is less than that from the control plots. The percentage of selects also shows a considerable decrease and it is the lowest on record since the experiments were started.

When the value of the probable increase for each plot is calculated and the cost of manuring deducted, as shown in diagram II, plot 4 alone shows a gain of $2.23.

KING'S BAY ESTATE—TOBAGO.

The fourth application of manures was made in April, 1914, but the land was not forked.

Inches.
Rainfall, July 1, to June 30... ... ... 1911-12 = 66·71
1912-13 = 64·57
1913-14 = 64·45
1914-15 = 62·36

TABLE VI.—MANURIAL EXPERIMENTS, KING'S BAY ESTATE, TOBAGO.

Trees 20 to 25 years old in 1911.

Plot.	No. of bearing trees.	Manures applied per tree *each year from 1911.*	Crop July 1, to June 30.	Average number of nuts picked per tree.	Per cent. Selects.	PER ACRE.					
						Selects.	Culls.	Value of increase or decrease on crop 1911-12.	Value of probable increase or decrease due to manuring.	Cost of manuring.	Gain or loss on average of *no manure* plots.
								$ c.	$ c.	$ c.	$ c.
1	51	4 lb. Lime ...	1911-12	74·4	70·1	3,914	1,669				
		4 ,, Kainit...	1914-15	98·7	60·3	4,463	2,938	+32.76	- 39.05	4.67	-43.72
2	67	6 lb. Basic slag	1911-12	56·2	67·2	2,831	1,382				
		1 ,, Sulphate of potash	1914-15	104·0	66·9	5,220	2,583	+77.74	+5.93	6.82	- 0.89
3	54	**Control — No manure**	**1911-12**	**60·3**	**68·0**						
			1914-15	**107·1**	**64·7**						
4	72	4 lb. Basic slag	1911-12	51·1	69·1	2,649	1,185				
		2 ,, Nitrate of soda	1914-15	106·8	52·4	4,197	3,813	+78.12	+6.31	7.86	- 1.55
5	69	2 lb. Calcium cyanamide...	1911-12	67·6	67·0	3,395	1,673				
		2 ,, Sulphate of potash...	1914-15	108·7	43·0	3,506	4,648	+47.40	- 24.41	8.94	-33.35
6	7	**Control — No manure**	**1911-12**	**58·4**	**68·2**						
			1914-15	**116·0**	**40·9**						
7	67	2 lb. Bone meal ...	1911-12	54·1	68·7	2,789	1,271				
		1 ,, Sulphate of ammonia...	1914-15	117·7	51·0	4,502	4,326	+88.65	+16.84	6.11	+10.73
8	74	2 lb. Dissolved bones	1911-12	60·4	67·1	3,042	1,492				
		1 ,, Sulphate of potash	1914-15	140·2	74·7	7,855	2,660	+137.84	+66.03	5.17	+60.86
		Average of Control plots ..	**1911-12**	**59·2**	**68·2**	**3,027**	**1,412**				
			1914-15	**112·3**	**50·2**	**4,229**	**4,196**	**+71·81**			

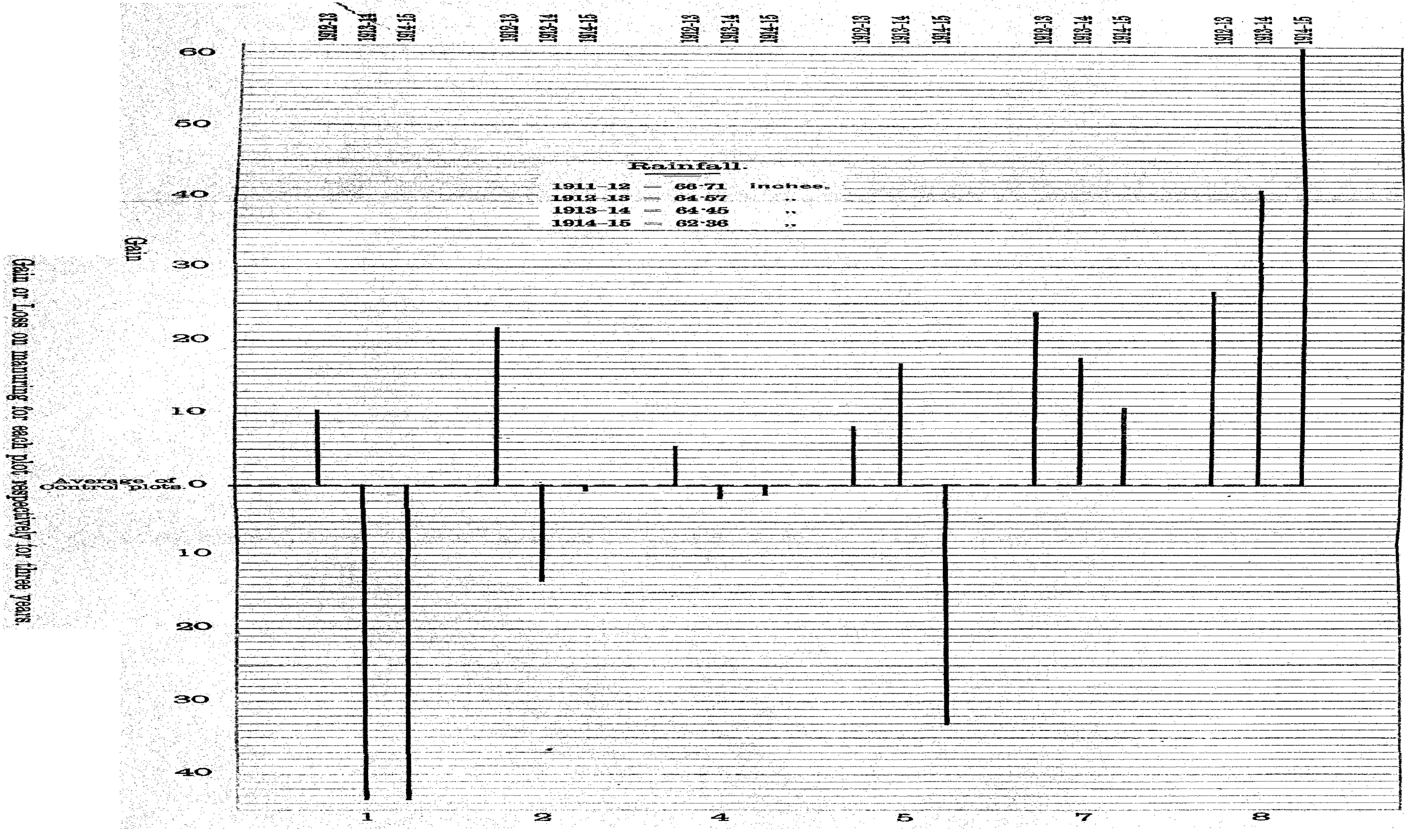
There has been a large increase in yield from all of the plots compared with 1911-12 and it will be observed that plots 4, 7 and 8 have given a larger increase than the control plots.

For the period under review, plot 8 alone has given a larger percentage of selects than for 1911-12, but the decrease in the percentage of selects is less for plots 1, 2, 4 and 7 than for the control plots.

When the value of the probable increase for each plot is calculated and the cost of manuring deducted, as shown in diagram III, plots 7 and 8 show a gain of $10.73 and $60.86 per acre respectively.

Diagram III.—King's Bay's Estate, Tobago.

Showing net pecuniary results per acre.



Explanation of Diagram—*Vide* page 57.

NATURAL YIELD OF PLOTS.

The figures obtained for the *natural yield* plots for this and the previous year are given in Table VII.

TABLE VII.—NATURAL YIELD OF PLOTS.

Plot.	January 1 to December 31.	PLAISANCE ESTATE, CLAXTON'S BAY. *Trees 20 years old in 1913.* Rainfall, 1913—52·77 : 1914—44·91.					*STE. MARIE ESTATE, TOBAGO. Rainfall, 1913—41·83 : 1914—35·54.				
		Average number of nuts picked per tree.	Per cent. Selects.	Per Acre.			Average number of nuts picked per tree.	Per cent. Selects.	Per Acre.		
				Selects.	Culls.	Value of Crop.			Selects.	Culls.	Value of Crop.
						$ c.					$ c.
1	1913	27·5	40·5	837	1,229	39.36	41·3	36·1	1,116	1,976	57.54
	1914	37·3	27·3	764	2,036	49.64	31·2	39·9	934	1,408	44.47
2	1913	22·8	43·5	742	965	33.02	29·4	38·8	856	1,351	41.66
	1914	37·9	31·4	893	1,950	51.57	27·5	58·8	1,214	850	43.10
3	1913	23·5	40·4	711	1,050	33.52	28·5	44·9	959	1,178	41.64
	1914	31·1	28·5	664	1,667	41.60	26·3	48·8	964	1,012	39.28
4	1913	20·9	42·0	659	910	30.12	10·7	15·0	120	680	13.20
	1914	34·3	27·6	710	1,862	45.68	19·7	47·6	704	776	29.24
5	1913	24·0	39·8	716	1,084	34.16	17·0	20·9	266	1,009	21.78
	1914	31·1	33·1	773	1,562	42.75	20·9	44·3	695	873	30.47
6	1913	25·7	43·5	839	1,091	37.34	24·2	44·1	801	1,016	35.26
	1914	40·6	26·9	820	2,227	53.90	17·0	47·3	603	672	25.15
7	1913	21·9	39·1	643	1,003	31.12	30·6	38·0	872	1,423	43.14
	1914	32·6	31·2	762	1,681	44.26	27·6	43·4	898	1,172	40.03
8	1913	22·2	43·1	717	947	32.13	62·6	16·1	756	3,938	77.97
	1914	25·4	34·1	650	1,257	35.10	48·9	15·4	564	3,102	60.63
9	1913	19·1	44·6	639	794	27.88	73·4	16·6	914	4,591	91.71
	1914	31·2	40·1	939	1,402	44.50	65·7	19·2	946	3,979	83.33
10	1913	17·5	45·3	596	720	25.70	70·3	11·3	596	4,675	85.02
	1914	27·8	53·6	702	1,387	38.35	70·5	10·8	571	4,716	85.01
11	1913	21·0	46·3	729	846	30.91	70·7	12·7	673	4,630	86.27
	1914	42·3	31·7	1,076	2,320	61.70	62·4	7·7	360	4,321	73.81
12	1913	18·6	53·7	584	504	22.16	93·1	21·3	1,488	5,499	119.68
	1914	43·6	33·7	1,194	2,350	65.10	78·9	13·9	816	5,052	96.18
13	1913	21·8	52·5	860	778	33.17	57·2	18·4	790	3,503	72.29
	1914	40·5	28·1	853	2,182	54.05	51·8	10·9	423	3,459	62.46
14	1913	22·3	51·8	865	805	33.70	58·8	20·4	900	3,512	75.18
	1914	37·2	40·1	1,118	1,671	53.01	45·2	14·3	485	2,907	55.73

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* Soil for plots 1 to 7 is a clay loam situated on a plateau about 100 feet above sea level. Trees 22 years old in 1913.

Soil on which plots 8 to 14 are situated, is sandy and on the Mount Irvine beach, barely ¼ of a mile from plots 1 to 7. Trees about 50 years old in 1913.

A comparison of the figures recorded above for Plaisance estate shows that, for 1914, the yield varies from 25·4 to 43·6 nuts per tree for plots 8 and 12 respectively or a difference of 1,365 per acre. Again the percentage of selects varies from 26·9 to 40·1 for plots 6 and 9 or 12 respectively. When, however, these two factors viz.:—the yield per acre and the percentage of selects are taken into consideration the value of the produce varies from $35.10 to $65.10 for plots 8 and 12 respectively, *i.e.* a difference of $30.00 between the plots giving the highest and lowest results. Similarly there is a difference of $19.32 and $40.45 between the highest and lowest figures for plots 1 to 7 and plots 8 to 14 respectively, on the Ste. Marie estate plots. This again clearly shows that this year no single plot could have been considered as a control for the other plots.

If we compare the figures recorded in Table VII, for 1913 and 1914, for each plot respectively it will be seen that:—

1. On the Plaisance estate there is (*a*) an increase in the number of nuts picked (*b*) a decrease in the percentage of selects from all of the plots and (*c*) that when these two factors are taken into consideration all the plots show an increase in the value of the crop.

2. On the Ste. Marie estate for plots 1 to 7 there is (*a*) a decrease in the yield from five plots (*b*) an increase in the percentage of selects for all of the plots and (*c*) a decrease in the value of the crop from four plots.

3. On the Ste. Marie estate for plots 8 to 14 there is (*a*) a decrease in the yield from six plots (*b*) a decrease in the percentage of selects from six plots and (*c*) a decrease in the value of the crop from all the plots.

This also shows that the variations in the yield, the percentage of selects and the value of the crop from one year to another are not uniform for all of the plots but when taken over a series of several years it is probable that these differences will be greatly reduced.

The increase or decrease for each plot respectively compared with the previous year is more conveniently seen on reference to Table VIII. A minus sign (−) indicates a decrease; the figures without any sign in fron indicate increases.

TABLE VIII.—NATURAL YIELD OF PLOTS SHOWING THE INCREASE OR DECREASE OF CROP 1914 ON CROP 1913.

Plot.	PLAISANCE ESTATE.			STE. MARIE ESTATE.		
	Number of nuts picked per tree.	Per cent. "Selects."	Value of crop.	Number of nuts picked per tree.	Per cent. "Selects."	Value of crop.
			$ c.			$ c.
1	9·8	- 13·2	10.28	- 10·1	3·8	- 13.07
2	15·1	- 12·1	18.55	- 1·9	20·0	1.44
3	7·6	- 11·9	8.08	- 2·2	3·9	- 2.36
4	13·4	- 14·4	15.56	9·0	32·6	16.04
5	7·1	- 6·7	8.59	3·9	23·4	8.69
6	14·9	- 16·6	16.56	- 7·2	3·2	- 10.11
7	10·7	- 7·9	13.14	- 3·0	5·4	- 3.11
8	3·2	- 9·0	2.97	- 13·7	- 0·7	- 17.34
9	12·1	- 4·5	16.62	- 7·7	2·6	- 8.38
10	10·3	- 11·7	12.65	0·2	- 0·5	- 0.01
11	21·3	- 14·6	30.79	- 8·3	- 5·0	- 12.46
12	25·0	- 20·0	42.94	- 14·2	- 7·4	- 23.50
13	18·7	- 24·4	20.88	- 5·4	- 7·5	- 9.83
14	14·9	- 11·7	19.31	- 13·6	- 6·1	- 19.45

SILK CULTURE.

REPORT ON SILK FROM TRINIDAD.

Samples of silk produced in Trinidad by three species of silk worm reared by Mr. M. C. Glaudon of St. Joseph, who has for several years taken a keen interest in sericiculture, were sent to the Imperial Institute, London in July 1915. The following report on these samples has recently been received from the Director of the Imperial Institute. Certain documents referred to in the report, *e.g.* Mr. Urich's historical account of Silk Culture in Trinidad and his recommendations for future work, and Mr. P. L. Guppy's records of previous experiments will be published subsequently :

The samples of silk which are the subject of this report were forwarded to the Imperial Institute by the Colonial Secretary with letter 4141/1915/1907 dated July 30, 1915. The samples were stated to have been produced in Trinidad by Mr. M. C. Glaudon.

DESCRIPTION OF SAMPLES.

(1) "Mulberry Silk (white variety)."—Weight ¼ oz.

This sample consisted of cocoons of dark cream colour externally, having the usual appearance of mulberry silk cocoons (*Bombyx mori*), and measuring on the average about 1·3 inch in length and 0·7 inch in diameter. The average weight was 0·39 gram. The cocoons were not pierced, and contained dead chrysalides.

The silk appeared to be of normal strength and character. The diameter of the double fibre or "bave" measured up to approximately 0·0009 inch, and that of the single fibres was mostly about 0·0004 inch.

These cocoons appear to be of good quality. Silk cocoons of a good grade fetch in normal times about 4s. per lb. in Marseilles, and cocoons resembling those of the present sample should sell in quantity at rather lower prices, probably at 3s. to 3s. 6d. per lb.

(2) "Mulberry Silk (yellow variety)."—Weight ⅛ oz.

This sample consisted of yellow cocoons, having the usual appearance of mulberry silk, and averaging about 1·2 inch in length and 0·7 inch in diameter. The average weight was about 0·26 gram.

The silk appeared to be of normal strength and character. The approximate diameter of the double fibre or "bave" measured up to 0·0010 inch, and that of the single fibres from 0·0004 to 0·0005 inch.

These cocoons had been pierced by the moths. Pierced cocoons can only be used for the manufacture of "spun" silk yarns, by "carding" the silk, as it is impossible to unwind such cocoons. They sell in normal times at about 1s. 3d. per lb. in the United Kingdom. The piercing of cocoons should be prevented by killing the chrysalides, either by careful heating in an oven or by immersion in boiling water.

(3) "Eri Silk."—Weight ⅙ oz.

This sample consisted of white cocoons with bluntly pointed ends, having the usual appearance of Eri silk cocoons, and measuring about 1·7 inch in length and 0·7 inch in diameter. The average weight was about 0·33 gram.

The silk was of good colour and strength. The approximate diameter of the double fibre or "bave" measured up to 0·0015 inch and that of the single fibres from 0·0005 to 0·0007 inch.

Owing to the structure of Eri silk cocoons the silk cannot be reeled, but must be carded. The silk is easily degummed by boiling with soap solution. The uniform white colour of the present sample would be advantageous, as Eri silk often contains reddish-brown cocoons which are objectionable. A previous sample of Eri silk examined at the Imperial Institute in 1907, which was inferior to the present material, was valued at about 1s. per lb.

(4) "NATIVE SILK WORM (*Attacus hesperus*)."—Weight $\frac{1}{12}$ oz.

This sample consisted of three cocoons measuring from 2·1 to 2·5 inches in length and 0·9 to 1·2 inch in diameter, and varying in colour from dark green to pale greyish brown. The average weight was 0·8 gram. The cocoons were bluntly pointed, and bore a long ribbon-like attachment at one end. The texture was papery and very tough.

This silk could not be reeled, and it possessed the further disadvantage of being difficult to degum, as boiling with soap solution, which is the usual treatment for Bombyx silk and is sufficient also for Eri silk, proved insufficient in the present case. Sodium carbonate solution was also ineffective, and it was necessary to use dilute caustic soda.

The quantity of silk available was too small to allow of further experiments in degumming, etc., but the material does not appear to be of a promising character, and would only realise a low price, probably lower than even that of Eri silk, which it resembles in microscopic appearance. The approximate diameter of the double fibre of "bave" measured up to 0·002 inch, and that of single fibres from 0·0006 to 0·0008 inch.

REMARKS ON THE POSSIBILITIES OF SERICICULTURE IN TRINIDAD.

In view of the results of the various experiments which have been carried out in Trinidad, there seems no doubt that silkworms can be reared successfully in the Island. It might be possible, therefore, to establish silk-culture as a village industry which could be carried on chiefly by the women and children. Such an industry would increase the resources of the Colony without withdrawing labour from other occupations.

In the papers accompanying the Colonial Secretary's letters of July 30 and August 9, no less than seven different kinds of silkworms are mentioned, viz.: (1) the mulberry silkworm (*Bombyx mori*); (2) the Eri worm (*Attacus ricini*); (3) the Trinidad silkworm (*Attacus hesperus*); (4) *Attacus cynthia*, the Ailanthus silk moth of northern China and Japan; (5) *Antheræa pernyi*, the Mongolian oak-feeding silkworm; (6) *Telea polyphemus*; and (7) *Callosamia promethea*.

In considering which of these silkworms is best adapted for culture in Trinidad, *Telea polyphemus* and *Callosamia promethea* may at once be ruled out, as they are very little known commercially, and Mr. Lechmere Guppy, jr. in experimenting with them in 1893 failed to obtain any results. With regard to *Attacus cynthia* and *Antheræa pernyi*, the preliminary experiments afford evidence that these insects can be reared in Trinidad, but much more work would be required before it was proved that they could be cultivated successfully on an industrial scale and in the absence of their native food-plants.

With reference to the indigenous silkworm *Attacus hesperus*, it might perhaps be worth while to ascertain whether this species could be domesticated, but in any case, it seems probable that it would not yield better results than the Eri worm, and the silk of the latter has the advantage of being well known in the European and American markets. Moreover, *Attacus hesperus* may perhaps be objectionable on account of the irritating hairs borne by the worms, which might cause troublesome skin affections to the workers. It might be worth while, however, to adopt the Government Entomologist's suggestion No. 3 in his memorandum of July 20, 1915 to the Acting Director of Agriculture, with the object of testing the possibilities of this insect, of which so little is at present known.

It thus seems advisable that attention should at first be directed in Trinidad particularly to the mulberry silkworm and the Eri silkworm. These varieties have the advantage that their respective food-plants grow well in the island, and could readily be planted in any desired quantity. Suggestions Nos. 1, 2 and 4 in the above-mentioned memorandum by the Government Entomologist should therefore be acted on.

It is not unlikely that the Eri silkworm will eventually be found more suitable for the purposes of a local industry in Trinidad than the mulberry worm, since (1) it can withstand a higher temperature than the mulberry worm and would probably be more easily acclimatised in the Colony, and (2) the Eri silk is more easily handled, as it is not necessary to kill the chrysalis, and the cocoons, after the moths have emerged, only require to be turned inside out and cleaned (an operation which can be readily accomplished either by hand or by comparatively inexpensive machinery), and can then be packed closely in bales for export.

Imperial Institute,
December 17, 1915.

METEOROLOGY.

RAINFALL RETURN FOR JANUARY, 1916.

Stations.	January, 1916.	January, 1915.
North-west District.	Ins.	Ins.
St. Clair—Royal Botanic Gardens	5·29	2·10
Port-of-Spain—Colonial Hospital	2·88	1·35
,, Royal Gaol	3·69	1·98
,, Constabulary Hdqr's.	2·90	...
St. Ann's—Reservoir	4·81	3·75
Maraval— ,,	6·28	2·29
,, Constabulary Station	6·72	2·43
Diego Martin—Constabulary Station	7·00	2·22
,, Waterworks	6·57	1·92
,, River estate	6·25	1·84
Fort George Signal Station	5·46	2·42
North Post ,,	5·66	1·23
Carenage Constabulary Station	7·14	2·18
Carrera Island Convict Depôt	5·70	0·59
Chacachacare Lighthouse	4·16	1·75
Santa Cruz—Maracas District.		
Santa Cruz—Constabulary Station	7·38	2·36
St. Joseph—Government Farm	3·94	2·50
,, Constabulary Station	2·72	2·39
Tunapuna—St. Augustine estate	2·97	2·09
Maracas—Government School	6·99	2·95
,, Ortinola estate	7·15	3·09
Caura—Wardour estate	4·68	1·88
West Central District.		
Caroni—Frederick estate	3·74	2·57
Chaguanas—Constabulary Station	4·37	2·69
,, Woodford Lodge estate	4·38	2·79
Carapichaima—Waterloo estate	5·13	3·39
,, Friendship Hall estate	3·80	4·55
Couva—Exchange estate	3·46	4·99
,, Brechin Castle estate	5·33	4·16
,, Perseverance ,,	3·50	3·86
,, Camden ,,	5·17	3·47
,, Milton ,,	6·09	5·21
,, Spring ,,	6·85	4·76
,, Constabulary Station	4·92	4·26
,, Esperanza estate, Savonetta	5·98	5·33
Montserrat District.		
Montserrat Constabulary Station	5·84	5·26
Brasso—La Vega estate	9·18	6·40
Arima District.		
Arima—Warden's Office	4·19	0·67
,, Torrecilla estate	5·43	3·54
,, Verdant Vale estate	6·80	4·71
San Rafael—Constabulary Station	8·89	5·47
Guanapo—Talparo estate	7·56	5·69
,, San José Estate	9·59	7·63
Tamana—Sta. Marta estate	11·12	8·44
,, La Corona estate	10·87	...
San Fernando & Princes Town District.		
Claxton's Bay—Forres Park estate	6·63	4·51
Pointe-à-Pierre—Bonne Aventure est.	5·90	5·91
,, Concord estate	6·66	7·01
,, Plein Palais estate	5·80	3·97
Naparima—Picton estate	5·75	6·01
,, Usine St. Madeleine	6·95	4·76

RAINFALL RETURN FOR JANUARY, 1916.—CONTD.

Stations.	January, 1916.	January, 1915.
San Fernando and Princes Town District.—(Cont'd.)	Ins.	Ins.
Naparima—Lewisville	8·08	6·34
,, Tarouba estate	4·52	8·39
,, Union Hall ,,	6·63	3·52
,, Palmiste ,,	5·84	4·58
,, Hermitage ,,	5·19	4·81
Princes Town—Craignish ,,	7·10	5·83
,, Cedar Hill estate	6·90	4·60
,, Williamsville estate	10·87	6·29
,, Esmeralda estate	8·46	6·57
,, New Grant estate	6·73	8·49
,, Constabulary Station	6·18	3·54
,, Hindustan estate	7·05	6·35
,, La Retraite estate	12·64	9·12
,, Malgretoute estate	8·91	5·19
Savana Grande—Friendship & Ben Lomond estates	8·64	5·77
Poole—El Rosario estate	11·94	7·95
Petit Morne estate	6·75	...
South-west District.		
Oropuche—Constabulary Station	5·55	7·46
,, Pluck estate	7·19	6·08
Siparia—Constabulary Station	4·88	6·42
,, Alta Gracia estate	7·20	4·82
Guapo—Adventure estate	5·22	3·64
Point Fortin—Constabulary Station	5·96	4·77
Erin—La Ressource estate	1·98	4·72
,, Industry estate	5·78	4·01
Cedros—La Retraite estate	7·33	3·99
,, Constabulary Station	6·59	3·05
,, Beaulieu estate	6·70	...
,, Perseverance estate	6·90	3·27
,, St. Marie estate	7·00	3·28
Icacos —Constance estate	6·61	2·75
Irois—Government School	6·78	5·78
South Coast.		
Moruga—Constabulary Station	4·69	4·02
East Coast.		
Matura—La Juanita estate	7·24	3·53
Manzanilla—Constabulary Station	10·53	6·15
Sangre Grande—San Hilario estate	6·98	...
,, New Lands estate	9·03	8·82
,, Evasdale estate	9·96	6·27
,, Grosvenor estate	10·43	5·98
Mayaro—Constabulary Station	9·08	6·21
North Coast.		
Blanchisseuse—Constabulary Station	9·12	4·50
Grande Rivière—Mon Plaisir estate	9·54	3·10
Toco—Aragua House	6·26	4·78
,, Constabulary Station	5·87	3·27
Point Galera—Light House	1·98	1·65
Tobago.		
Tobago—Hermitage estate	8·91	3·80
,, Riversdale ,,	4·05	3·66
,, King's Bay ,,	8·55	4·89
,, Roxburgh	11·33	6·73
,, Lure estate	10·21	6·25
,, Botanic Station	7·48	4·02
,, Government Farm	4·63	2·60
,, Lowlands estate	5·94	3·69
,, Friendship estate	5·63	3·80
, Bon Accord estate	6·19	2·95

EXPORT TAXES ON AGRICULTURAL PRODUCTS, 1916.

The following are the export taxes on agricultural products for 1916 as compared with those for 1915. The Agricultural Fund is for the purposes of the Board of Agriculture. The Emergency Fund dates from 1915 when it was instituted for the purpose of raising "certain emergency funds required in view of local conditions consequent on the present war."

	Immigration Fund.		Agricultural Eund.		Emergency Fund.		Total.	
	1915.	1916.	1915.	1916.	1915.	1916.	1915.	1916.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Sugar *per 1000 lb.*	1 6	5 4	1⅞	1¼	3 0	2 6	4 7⅞	7 11¼
Molasses *per 100 gals.* ...	1 0	2 2	Nil.	Nil.	Nil.	Nil.	1 0	2 2
Rum and Bitters *per 100 gals.*	2 10	6 10	Nil.	Nil.	...	...	2 10	6 10
Rum *per 100 gals.*	...	...	...	...	...	8 4	...	8 4
Cacao *per 100 lb.*	1½	6	¾	¾	2½	6	4¾	1 0¾
Coffee *per 100 lb.*	4	1 0	Nil.	Nil.	Nil.	Nil.	4	1 0
Coconuts *per 1000 nuts* ...	4	1 9	1¼	1	1 6	3 0	1 11¼	4 10
Copra *per 1000 lb.*	1 3	7 1½	2½	2½	5 0	5 0	6 5½	12 4

Three Cacao Merchants in Port-of-Spain have advertised that they will not deduct the Agricultural Fund Tax when purchasing cacao.

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BULLETIN
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PART 3.] 1916. [VOL. XV.

SUGAR.

THE PRICE OF FARMERS' CANES.

THE following is a report, revised by the respective speakers, of the discussion on the price of canes grown by Cane-farmers which took place at the meeting of the Board of Agriculture on February 23, 1916. At the conclusion of the discussion the scale of prices was adopted and forwarded to the Government:—

Professor P. Carmody, Chairman of the Sugar Committee, presented the following report on the question of the scale of prices for farmers canes:—

It is the opinion of those members of the Sugar Committee present at this meeting, that a scale of prices for farmers' canes is desirable in the interests of the sugar industry of the Colony, and that a fair basis for such a scale would be an equal division of proceeds between buyer and seller, based on the f.o.b. price of grey crystals at Port-of-Spain.

The Committee has held seven meetings and has considered four scales which have been submitted, and from these the Committee at its final meeting has prepared the following scale:—

SUGGESTED SCALE OF PRICES FOR FARMERS' CANES.

TONS OF CANE PER TON OF SUGAR, ALL GRADES.

	10		11		12		13		14	
F.OB. Value of Grey Crystals.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
£17	14	0	14	0	13	4	12	4	11	5
16	14	0	13	7	12	6	11	6	10	9
15	14	0	12	8	11	8	10	9	10	0
14	13	0	11	9	10	10	10	0	10	0
13	12	0	10	10	10	0	10	0	10	0
12	11	0	10	0	10	0	10	0	10	0
11	10	0	10	0	10	0	10	0	10	0
10	10	0	10	0	10	0	10	0	10	0

This scale is intended for the year 1916 only, and if found to work successfully, might be continued or modified, as found desirable in future years.

It is intended for the guidance of buyers and sellers, but if they agree to make contracts outside the scale, they should be at full liberty to do so.

It is suggested that in practice the price should be calculated to the nearest ten shillings and to the nearest half ton.

It is also suggested that the payment at time of purchase should this year be ten shillings, and that the balance of the price be paid in the form of a deferred payment, when the accounts have been made up and the average F.O.B. price and the tonnage of canes required to produce a ton of sugar have been ascertained.

* * * * *

In moving the adoption of the above Professor Carmody said that although the report just read was a unanimous one of the members of the Sugar Committee present at the last meeting, it was right that he should say that at previous meetings some other members of the Committee did not approve of a similar scale. The scale he was now submitting to them shewed a minimum price of canes at 10s. per ton and a maximum price of 14s. a ton, with intermediate prices according to the prices obtained for sugar. In introducing the question to the Board he might say that this was a scale prepared by the Sugar Committee and that he was not speaking here in his official capacity but as Chairman of the Sugar Committee. It was this report of the Sugar Committee that was being submitted to the whole Board and if it was approved it would be forwarded to the Government for their information or any action that might be taken. The scale was not binding on either buyer or seller but it was intended that it should be put forward simply for the guidance of both. Scales had been worked with more or less continuity for a great many years, but the scales of those years had been based on prices obtained in the New York Market and these prices were duty paid. But subsequently objection was taken, especially last year, to the basis of the scale being the New York prices and it was thought that the prices obtainable in England were the proper prices to use for their scale. The Committee carefully considered all the scales and the basis of them and had come to the conclusion that the f.o.b. prices of grey crystals in Trinidad at present, based on prices paid by the Royal Commission on sugar in England, were the fairest on which to base a scale. The previous scales to some extent were departed from and later on fixed prices were more or less prevalent throughout the colony. This in his opinion was worse than a scale. It appealed to the cane farmer, and also to the factories at the time but a fixed price was more or less arbitrary, for he might say, that it was fixed entirely by the factories and the farmer had very little,—if any voice in fixing the price to be paid. The factory naturally fixed a price as low as would ensure for them a profit on the year's working. The factory must necessarily avoid risks, and although in some cases, the factory had paid a fair price for the canes, still the natural tendency would be for the factory owner to fix a price that would ensure a profit to himself. With a fixed price for canes three results were possible. The price might be exactly just and equitable in which case the cane farmers and factory owners would be properly treated. The prices might be too low in which case the cane farmers would suffer and suffer not only an immediate monetary loss, but there would be no incentive to improve or extend their cultivation. They were all aware that cane farming was a solid part of their industry and it was to their advantage to encourage it in every legitimate way. If the prices fixed were too high as has been the case in some years, the result would be that the factory would lose and the industry and the colony as a whole would suffer. It would also mean that there would be no money left for the factory for improvements in manufacture and if that were to continue for a certain number of years it would mean the failure of the industry altogether. If the price paid by the factories was above that which would be profitable to them—and as they all paid more or less the same price—it would only be a question of the number of years when they would have lost their capital and they would no longer be able to continue in that industry. This is what has occurred to several proprietors,—they had lost their factories or they had been closed or transferred to other proprietors. The factory owners may say that if they fixed high prices, it was an ordinary business risk which they might take. He looked upon it, that it was rather more than that. If the industry suffered as a whole through the owners paying a higher price than they could afford to pay the industry was the loser, and the Government would be placed in a very awkward position if any serious damage were done to the prospects of either the cane farmer or the factory owner, or both. He was of opinion that a fixed scale of prices was not equitable to the factory owners. With a fixed price for canes it would be seen that it would not be fair or equitable that where a factory which took seventeen tons of cane to make a ton of sugar and another factory which took only 11½ tons of cane should pay exactly the same price for canes. Whether the increase in the tonnage of canes necessary to make a ton of sugar was due to the fact that one factory might be better equipped than another or it was due to the delivery of unripe canes, or canes of an inferior quality, or whether or not it was due to the difference between the quality of canes in different parts of the colony, the fact remained that if a factory which took 17 tons of cane to make a ton of sugar could afford to pay 11s. a ton, the factory which took 11½ tons of canes to make a ton of sugar must be making a very much larger profit in comparison. In preparing the scale the principles which occurred to him and to some of the other members of the Sugar Committee were :—

(1.) That there should be in any scale a reasonable profit for the factory.

(2.) That there should be an allowance made for the small factory.

(3.) That there should be an allowance made for the quality and ripeness of the canes.

(4.) That the f.o.b. prices should be fixed for the whole crop and not a portion of it.

(5.) That a share of the payment should be made to the farmer on delivery and there would be a deferred payment or bonus from the surplus profits when figures were available.

With regard to the first point—a reasonable profit for the factory, he said it was hardly necessary to urge the justice of that. If the factories did not make a reasonable profit they must sooner or later disappear. If there were no profits for a number of years the factories would have to close down and in consequence there would be no market for canes and cane farmers would suffer. With respect to the question of allowance to be made for the small factory, he thought that for the present it was desirable to keep the small factories going as it would be inadvisable to reduce competition among the buyers. The more buyers the better would be the prices paid to farmers. It also meant that if the small factories were to disappear there would be an increase in the cost of manufacture to the big factories through longer haulage of the canes to reach central factories. There was also another point; if the cane farmers were able to deliver canes which contained 10 per cent. of sugar and if the factory was not able to produce more than 8 per cent. of sugar the question would arise as to whether the farmer was not entitled to be paid for the whole 10 per cent. which his canes contained.

At the present time no attention was paid to quality. Lately—quite recently, the question of quality has been beginning to be realized and some canes of an admitted higher quality had been paid a higher price than the inferior canes. The difficulty of valuing the canes was however very considerable and could only be done by elaborate processes to test the quality and quantity of the juice. It would entail very elaborate work and would be impracticable where one had a large number of very small cane farmers to deal with. The tonnage of canes was taken and the factory could tell after the year's work the number of tons of canes required to make a ton of sugar. This would make no difference between estates and farmers' canes but the whole amount of canes taken would be considered also the whole amount of sugar produced. This was a rough method at getting at what was really sought—the idea of quality. For that reason he would say that the question of the price should be regulated to a certain extent by the tonnage of canes required to make a ton of sugar and it would have a considerable effect upon cane farmers in improving the quality of their canes because if they knew they would be getting more for superior canes they would grow them. With respect to the question of f.o.b. prices of the whole crop he said that under the old scale the prices were paid fortnightly and were based on the figures given in New York. Fluctuations might be very considerable between the time the canes were bought and the sugar sold and it left a considerable amount of risk either to the factory owner or a certain amount of loss to the cane farmers. The factory owner might probably make very careful calculation as to what were the prices of sugar during the period when his crop was available but still there were variable and he thought it would be much better to avoid these fluctuations by keeping to the f.o.b. prices paid in Port-of-Spain for the whole crop. It seemed to him the safest way to ensure profit to the factory and it would be much safer now that fluctuations were very high. With respect to the division of payment it might give a little more trouble. It might be said that it was unworkable but the best answer to this was that it was carried out by two or three estates in 1915. These made payment down and next gave bonuses—deferred payment when the profits were ascertainable. He would assure them that this had given great satisfaction to the farmers and he was almost sure that if the factories of the island were to adopt this principle the cane farmers would accept it. The members of the Committee had contrasted the scale drawn up with that prevailing elsewhere—in Antigua and in other places where there was a fairly large extent of sugar cultivations in the West Indies. Fortunately he had been enabled to obtain extremely reliable figures from the "West Indian Bulletin." He found that in Antigua for the five years ending 1914, the old contracting proprietors, as they were called there received 6·16 per cent. of sugar on the weight of canes delivered by them and the new contracting proprietors received 5·78 tons of sugar per hundred tons of canes. In Cuba the percentage of sugar varied from seven to six and in Barbados* during the crop of 1916. I have been informed that the factories would pay at the rate of 7 per cent. He thought Barbados was high and even taking into account the fact the Barbados canes were richer than Trinidad's it seemed a very high price to pay for canes. If they were to work out the f.o.b. prices at £15 per ton, it would come to about 21s. per ton and deducting 20 per cent. off Barbados canes as being superior to that of Trinidad's it would still leave about 16 to 17s. per ton as the price for canes. What the Committee proposed to do was to divide equally the net proceeds of the sale of the whole crop between factory owners and cane farmers and if it took 12 tons of cane to make a ton of sugar the factory owner would receive 4 1-6 tons of sugar per 100 tons of canes and the cane farmer an equal amount. If it took 10 tons of canes to make a ton of sugar then each of the parties would get 5 tons of sugar to every 100 tons of canes. It would not be reasonable for them to advocate the high price of canes as paid in Antigua where there were very large contracting proprietors while in Trinidad there were a number of very small farmers, who had very little capital. Besides they had to be supplied with advances and they paid very little regard at the present time to the quality of the canes and their cultivations in most cases were not what one would wish to see. Next there was no regular delivery to the scales and all these would necessarily increase the expenses of the factory for which some reasonable allowance should be made. He thought that the allowance made by the Sugar Committee between 4 1-6th tons of sugar to every 100 tons of canes in comparison with the 7 per cent. obtained at Barbados was a very fair one and no factory owner should say it was unreasonable. It was noted also in Trinidad that small farmers received advantages in the way of inducements which of course was something to consider with respect to the price paid for canes. In some cases where 11s. a ton was paid for canes; it was estimated that the advantage derived from other sources were put at from 1 to 3s. per ton of canes. Whether that was so or not he could not say. These advantages consisted of advances at low amounts of interest or none at all lands, at low rent, advances for the purchase of mules and houses the supply of haulage facilities or the supply of cane plants and moreover there was the advantage of payment on delivery. All these advantages had an appreciable value but what these advantages were per ton it was difficult to say except one had actual experience on the estate. He thought the new scale would help any one to find out the value of those advantages which had been in force for years, and would lead to some agreement as to whether 11/- was as advantageous to the farmer as 7 per cent. paid in Barbados. It was argued from the quotations published daily in the newspapers, that the factory owners were making enormous profit. As a matter of fact it could not be so, because from that 47/- per cwt. for Demerara crystals was to be deducted, Government profits, duty, freight and several other items. The result was that the only reliable guide to fall back on was f.o.b. prices for grey crystals. In a case like that where the prices of f.o.b. was £17 per ton, the scale would pay £8 10s. to the manufacturer and £8 10s. to the farmer. He hoped the new scale would not in any way tend to disturb the relations between farmer and factory owner. He thought a good deal of agitation in the past was due to ignorance of those prominent in the agitation, and the more the farmer understood the actual financial position of the sugar industry of the colony, the more likely he would be to come to some reasonable terms with the owner of the factory. To his mind every farmer should realize the fact that the profits which the factory owners obtained in 1915 should be applied to some extent to make up losses in previous years. The possibility was that now they had reached the turning point in the industry and that in future the Home Government would consider the industries of the Empire of more importance than it did in the past. It was known to all of them that the sugar industry of the colony was almost entirely crushed by competition with subsidized beet, and but for the Brussels Convention, there was no doubt it would have been crushed altogether. Now that the Home Government and the people found that they had to pay 6d. per lb. more for sugar, they would realize what the colonies had been preaching to them for years, and would not allow the sugar industries of the Empire to be extinguished. It was very probable that in the future the cane sugar industry would be fostered throughout the Empire to a much larger extent than hitherto and they hoped to obtain better prices for cane sugar. If that was so, it was only right that they in the colony should make every effort they could to place the industry on a better footing than hitherto. They could do that by helping both factory owner and farmer. Both should receive the support of the general community in order to place the industry on a sound and satisfactory basis. They must remember that in connection even with cane sugar, there was competition and it would be most profitable to those countries where the cost of production was least. In Cuba where extraction was carried out to the last degree, the consequence was that sugar could be produced at lower prices that elsewhere; profits were greater and the industry there was progressing at an enormous rate and it would continue to progress as long as there was land available for sugar cultivation. He was of opinion that if the sugar industry here was conducted on a sound basis, it could be a prosperous industry which could not be done without, and which was sure to prosper if they agreed upon something with a reasonable profit all round and a fair division between factory owner and farmer. The scale he had submitted would require their approval, and if adopted, it would be forwarded to the Government for information.

HON. SIR TOWNSEND FENWICK said:—After very careful consideration it was found by the Committee, that the scale itself was an admirable one and very possibly the best that could have been proposed in the circumstances. If it were to be confined to any one large factory, he could understand it working perfectly and smoothly, but it was not so confined. It was a scale proposed for a considerable number of factories, every one of which was working under different conditions from the other. The Chairman had referred to the cost of production which varied so widely throughout the colony, and on that basis no scale could be practically prepared. Possibly the farmer took an exaggerated view of the value of his canes when he saw present day prices, and the Chairman had rightly pointed out that from the profits that were to be made by the factories, a considerable reduction had to be made. He did not think that everybody interested had followed the subject with a view of finding out how much those reductions were, and perhaps he might best explain it by quoting figures connected with the largest of their sugar factories, namely, the Usine Saint Madeleine. Briefly put, the profit on the working of the factory for the 1915 crop was £4 10s. per ton of sugar—of this, the

Imperial Government took as its share of "Excess Profits"	£2	0	0
Required for renewals of Machinery this year ...	1	10	0
Remaining for distribution among the Shareholders	1	0	0
	£4	10	0

He was authorised to give these figures which had appeared in an official report. Circumstances affecting sugar estates were so widely different that it was impossible to make any scale apply equally to all. First, the quality of the sugar manufactured. Some factories made a very high class of yellow crystals, others made grey crystals, for which they got a considerably less price. In ordinary times, the difference between the yellow and grey crystals' prices was not more than 20s. to 30s. but at present, on account of war prices, whilst grey crystals remained at about the ordinary rate, yellow crystals had gone up to forty-seven shillings. Was the manufacturer of sugar which realised 17s. to pay the same price for his canes as the man who got the 47s.? Reverse the position: was the man who got 47s. for his sugar to pay only the same price as the man who got 17s. Then again there was a wide difference in the crushing power of the factories, therefore the farmers' canes were not of the same value to a factory which extracted not more than 60 or 65 per cent. of juice as there were to others that were better equipped and obtained 87 or 88 per cent. Here again is a huge disparity which would throw the scale out. There was also the richness or poorness of the canes corresponding to the richness or poorness of the surrounding soil. It might be argued that the scale provided for the difference in the quality of the canes, by basing prices upon the tons of canes required for the making of a ton of sugar—from ten to fourteen tons. Sir Townsend went on to say one point had never been explained to him yet: how could the quality possibly be determined? They could make one or twenty trials during the course of the crop, but they could not possibly get figures which would represent the quality of the whole year's crop of farmers' canes as compared with the estate's crop. That meant that the careful cultivation of estate canes went for nothing if they got mixed up with canes that probably received no cultivation at all in many cases and in few cases only cultivation equal to that of estate canes. So they would see that there was an enormous benefit to the farmer much to the detriment of the factory, in the mixture of farmer's canes. He saw his honourable friend on his right shake his head, and perhaps Mr. Kay would be able to explain later on how to discriminate between farmers' and estate canes when both were ground together. It would take a considerable amount of ingenuity to overcome the difficulty. A remark from the Chairman had struck him very much when he said that the result would be to greatly improve the cultivation of farmers' canes. He Sir Townsend, thought it really was the *one* thing to encourage the farmer to indulge in slovenly form of cultivation, if he knew all his canes would be merged with the estates, and they would reap the benefit. One point hardly realised except by the factory managers, was the enormous disadvantage of being compelled, through the factory making large purchases of canes, to start perhaps a month or three or five weeks before the canes were matured, and, in many cases, to continue grinding operations for two or three weeks after the sugar in the cane juice had begun to invert and weather conditions had become unfavourable. That was a loss to the factories, which has never been attempted to be estimated by anyone, but if they did at any time, they would very possibly be shocked. He did not think there was any factory in the colony that was able to take all the farmers' canes now offered without an early start and a late finish to the crop. All the attempts to form a sliding scale had arisen from what the newspapers had made out from different meetings; probably some were from very honourable motives with the endeavour to do something for a deserving class of the community others probably had some axe to grind, but he thought the majority were persons who opposed it right and left by writing letters to the Press and other means, in order to bring themselves into notoriety. Was there any case in the colony where the farmers had told factory owners that "unless they mend their ways" they were going to cultivate no more canes for them? Were not the farmers perfectly contented with things as they are? Assuming there was dissatisfaction let us have it, not as a vague generality but as concrete facts and as between such and such a farmer and a particular factory. How did they reconcile wide-spread dissatisfaction with the increase of the industry? If there had been dissatisfaction year after year, would the industry have extended in the overwhelming manner it had? Would every rood of land within reasonable distance of the factories have been rushed and scrambled for, as it had been? Would not those men who had been dissatisfied with one particular factory have given up their lands, which were hired only, and gone into the neighbourhood of another factory where they were better treated? Was there one instance of that? He, the speaker, had made careful enquiry, and had heard of none. He had no belief in the existence of that dissatisfaction. He knew the farmers at Tennants, Waterloo. Bronte and other places were perfectly satisfied and worked harmoniously with the factory owners. He was much afraid that the cane farming industry was vastly overdone. It had reached such proportions that the owners were constrained to protest, and if things went on as they were, farmers would find themselves in very great difficulty. They would find that after spending their labour in raising canes, there would be a difficulty in finding purchasers for them. This was so at the present moment. He was speaking principally from his knowledge of the Ste. Madeleine factory having built that place and having been in charge there for years. At the present time, there was a rush of applications to the factory for farmers to have their canes taken and the factory was refusing them right and left. What was going to become of these men? Apart from Tennants and Ste. Madeleine factory he did not know where they could go. Perhaps some would go to Bronté which was a long distance but he doubted whether they would be able to do it. [Mr. McLeod : Really we can't take canes as fast as they bring them in.] That was the difficulty. Then there was the suggestion to give farmers half the profits of the factory. At the best they could only discriminate and take tests of the *bulk* of the farmers' canes, and, may be, there would be from ten or fifteen to three hundred farmers' canes dumped into one heap, but when tested what had they arrived at? Nothing that could do justice to any particular farmer, but rather to benefit all those who had taken no care of the cultivation of their canes at the expense of those who had used their best efforts towards producing the best canes possible. The Chairman had said that if the scheme was approved by the Board it would be sent to the Government for any action they might see fit to take. He was under the impression that the Government seeing the error of their ways, did not intend to take any action at all with regard to the question, but leave it instead to the Board of Agriculture to settle between owners and farmers. Any arrangements of the kind which could not be legally enforced and which contained no penal clause was not worth the paper on which it was written. He was authorised to say on behalf of the Ste. Madeleine factory that they absolutely refused to be bound by any general scale which might be adopted by the Board, that they preferred to do their own business in their own way, and that if anything of the kind should, by any legal process, be made compulsory, they would give their farmers their congé.

HON. SIR NORMAN LAMONT said:—I must express at the outset my strong disagreement with, and my great regret at, Sir Townsend Fenwick's denial that dissatisfaction exists among the Cane farmers. Because that dissatisfaction has been expressed in a law-abiding and perfectly constitutional manner, to say that it does not exist is one of the most dangerous things ever said from this table. That remark may be taken as a challenge by every farmer in the colony. If legitimate representations of their grievance by means of letters to the Press, of deputations to the Governor, of meetings among themselves, and of not cutting their canes, does not sufficiently express their dissatisfaction, then farmers are entitled to ask Sir Townsend Fenwick by what means he *would* be convinced of that dissatisfaction? Perhaps as a farmer myself, I am in a better position to know whether there is dissatisfaction than anyone else at this table, and I assert that it undoubtedly exists. If it has been expressed in a law-abiding manner, that is only because we are fortunate in having an exceedingly long-suffering and patient class of people for our Cane-farmers, who are evidently content to wait on the Government to see that justice is done. They are confident, after the presence of the Director of Agriculture at the meeting at Princes Town last year, and after His Excellency's speech at San Fernando at the Agricultural Exhibition the other day, that the Government will see that they have fair play.

But I venture to say that farmers are in a considerably worse position than last year at this time. The price of sugar is very much higher; the quality of the canes is very much richer; yet the price offered to the farmer is the same eleven shillings, without any prospect of a bonus whatever. The farmers, for many years past, during the evil days of the sugar industry, have been one of the mainstays and supports that have helped to carry it through. During that time they waited patiently for better days. Now, that better days have come, they ask to be allowed to have some small share in the prosperity, but they have found that they are allowed no share whatever. In January 1909 Demerara crystals were quoted 16s. to 17s. 6d., in 1910 from 16s. 3d. to 17s. 3d., in 1911 from 15s. to 15s. 6d., in 1912 from 18s. 9d. to 21s., in 1913 from 16s. 9d. to 18s. 9d., in 1914 from 14s. to 14s. 6d. Now they are quoted from 44s. to 47s. as compared with 1914 that is a rise of 200 per cent. and the farmers are given an increase of 10 per cent. in the price of their canes! That requires a good deal of explanation. More explanation still is demanded when it is remembered that the price of rum has risen from about 10d. to 4s. per gallon! It is quite true, as Sir Townsend Fenwick has said, that from these prices considerable deductions have to be made. But I beg to point out that the British 50 per cent. Excess profits Tax is not a tax on the whole of the profits, but on the amounts by which those profits "exceed the pre-war standard" of profit. Moreover, that tax falls only upon firms domiciled at home, and does not affect estates owned by residents here. Local proprietors who sell locally pay no excess profits tax, no British import duty, no extra freight charges, no local immigration tax, agricultural tax, or emergency tax, though there has been a 200 per cent. increase in the price of sugar, and a 300 per cent. increase in the price of rum. Nor has there been any increase here in the cost of labour.

Mr. Wallace in a long and interesting interveiw, which he accorded to *The Mirror* on November 22, took the value of Demerara Sugar as then £29 10s. per ton in London; and gave the freight, duty, and other charges as £3 10s., £8 3s. 4d., and £1 11s. 6d. respectively, making in all a total of £13 4s. 10d. to be deducted. Well, to-day the freight may have risen to £5 per ton, and the price of sugar is now quoted £44 to £47 per ton. But I hear of no proposal to pay any more to the farmer.

The fact is that the farmer is actually worse off in spite of the rise in the price of sugar since the war, for he has to pay an increased tax on his mule-cart or donkey-cart, as well as a large increase in the cost of living. It is said that farmers are given sundry "inducements" over and above the price which they receive for their canes. Mr. Carlee has lately given a long and eloquent description of what has been done by his firm by way of "inducements" in the shape of housing-accommodation, water-supply, and even a "bonus on babies"! Now I am quite sure that the average farmer would rather have a bonus on canes than a bonus on babies. The great Duke of Wellington was in the habit of saying that "the Battle of Waterloo was won on the playing fields of Eton." For local use that dictum will have to be revised, and we must announce that "the successes of Waterloo are won in the cradles of Carapichaima"!

Sir Townsend Fenwick asked, "if the farmer is dissatisfied with his position, why does he go on growing canes"? The reply is first, that "hope springs eternal" even in the Trinidad farmer's breast. Secondly, the growing of canes is often the only job he knows. Thirdly, he prefers to work for himself rather than as a paid labourer on an estate. Fourthly, because the Crown lands are still closed, and the farmer is therefore unable to buy land for himself. Fifthly, because he very often does not know whether he is growing canes at a profit or not, as he takes no account of his own labour. I therefore plead very earnestly for the adoption of the scale before us. It will give the farmer better, at any rate slightly better terms. Factory-owners should ask themselves three questions:—First, what is the lowest price that I *can* pay? Secondly, what is the highest price that I *could* pay? Thirdly, what is a fair price that I *should* pay? I earnestly ask planters to look at the matter in that third aspect. I think that the principle on which this scale is based, namely the equal division of the sugar made from the cane, is eminently fair. The actual scheme, ably described by the Chairman, is based on a division of the value of the sugar free-on-board at Port-of-Spain. The planter gets the whole value of the rum. I think that it is only fair that if there is to be a minimum price, in order to guarantee the farmer against growing canes at a loss in years when the price of sugar is low, there should also be a maximum price to enable the factory-owner to recoup in the good years any loss he may have made in the bad.

This scale, then, is put forward as a very moderate, possible basis of settlement. No doubt, as the Chairman said, cane-farmers in Cuba, Antigua, and Barbados are getting far better terms than these, but I am convinced that this scale would be welcomed by our farmers as a satisfactory settlement of their long-standing plea for justice, for they are perfectly capable of understanding the distinction which the Director of Agriculture drew between the small farmers here, some of them not very expert agriculturists, and the large farmers in those islands, who probably grow canes quite as good as those of the factory itself.

I feel sure that educated, impartial public opinion will support the Board of Agriculture if it endorses the promulgation of this scale. In view of the origin of the prosperity which has so suddenly come to the sugar-industry here, it behoves planters, knowing and realising that this prosperity has come through no effort of their own, more than they were making before, but solely by reason of the colossal struggle in which our Empire is engaged—it behoves planters to see that they do not lay themselves open to the charge of endeavouring to "collar" the whole of that prosperity for themselves but to shew their willingness to distribute a certain proportion of it among their poorer fellow colonists.

HON. W. G. KAY said:—I do not propose to follow Sir Townsend Fenwick or Sir Norman Lamont into the general question as to whether a scale like this one is necessary or not, and will only say in passing that I do not quite understand from Sir Townsend Fenwick's remarks whether he was objecting to any scale at all or only to this particular one. It seems to me that the time has come when a scale of some kind should be put forward, as an effort fairly made to meet the wants of the farmers and of at least some manufacturers who have felt that something of the sort was desirable. It is for this purpose, I take it, that the scale has been put forward by the Committee, merely as a suggestion, and not with any intention of binding anybody. So far as I understand, it will go from the Board as a suggestion of what it would consider fair and reasonable under present conditions, and for 1916 only in the meantime. There are just two points which were mentioned by Sir Townsend Fenwick on which I wish to comment. The first is that in speaking of grey and yellow sugars he quoted greys as being worth £17 per ton and yellows at about £47 per ton. I do not disagree with these figures, but would like to point out that the one is an f.o.b. price in Port-of-Spain and the other is the highest price quoted in London and that it of course includes the extremely high rates of freight and insurance, and the very high duties which are now being paid in the United Kingdom. The two figures cannot be put alongside of one another at all. The other is in regard to farmers' canes being mixed with estates' and the farmers being paid on the basis of the average tons of canes required to make a ton of sugar. I do not think it was the intention of the Committee to suggest this. The intention was that farmers' canes be treated by themselves, and the average quantity of them taken throughout the entire crop to make a ton of sugar be made the basis for computation of prices to be paid. It is easily in the power of most manufacturers to arrive at the value of farmers' canes as distinct from their own. I do not think that there should be any difficulty in a well-arranged factory for the owner to have daily tests taken of farmers' canes by themselves, and that continued throughout the crop, so that at the end of the year the factory would be able to say with close approach to absolute accuracy that its own canes took so many, and the farmers' canes so many, tons to make a ton of sugar. It would not be fair, as Sir Townsend has said, that the farmer should reap the benefit of the estate's better cultivation and as a rule richer canes in consequence of it. But the farmer will soon find that by growing richer canes he will get a higher price for them, and he will naturally do so. Personally, I am in favour of a scale of some kind, and the one pu forward is the best and fairest I have seen up to now. If any one would suggest a better one I would give preference to it, but in the meantime this seems to me to be the fairest to both buyer and seller that has yet been put forward, and I intend to vote for its adoption.

On the question being put to the meeting a division was demanded and taken with the following result: –

In favour of the motion (6): Hon. Sir Norman Lamont, Bart., Hon. W. G. Kay, Messrs. J. d'Abadie, J. W. Arbuckle, A. B. Carr, and W. G. Freeman.

Against (3): Hon. Sir Townsend Fenwick, Messrs. J. Black and J. J. McLeod.

VALUES OF FARMERS' CANES.

According to figures that have recently been published in the *Proceedings of the Agricultural Society Trinidad and Tobago*, the sugar crop in 1915 gave at some factories a very low percentage of sugar. As it will be of interest to ascertain the approximate value of a ton of canes at each of the factories the following table has been prepared to show an estimate of that value when the quantity of canes required to produce a ton of sugar varies from 11 to 17 tons:—

Tons Canes to 1 ton Sugar ..	11	12	13	14	15	16	17
Lb. Sugar from 1 ton Canes...	204	187	172	160	149	140	132
Value of Sugar at £17 ꝑ ton $	7.43	6.82	6.26	5.82	5.42	5.10	4.80
Expenses as shown below $	3.60	3.29	3.03	2.82	2.64	2.47	2.35
Value of 1 ton of Canes $	3.83	3.53	3.23	3.00	2.78	2.63	2.45
Estimated Expenses, &c., on..	204 lb.	187 lb.	172 lb.	160 lb.	149 lb.	140 lb.	132 lb.
	c.	c.	c.	c.	c.	c.	c.
Manufacturing at £3 ꝑ ton	131·14	119·6	110·6	102·4	96	90	85·5
Depreciation at £1 ꝑ ton ...	43·71	39·9	36·9	34·13	32	30	28·5
Int. on Capital at 10/- ꝑ ton	21·85	20·	18·45	17·07	16	15	14·25
Haulage, &c. at £1 5s. ꝑ ton	54·64	50·	46·1	43·13	40	37·5	35·6
War Tax at 3/- ꝑ 1,000 lb.	14·68	13·53	12·38	11·52	10·72	10·08	9·58
Immigration Tax at 1/6 ꝑ 1,000 lb.	7·34	6·77	6·19	5·76	5·36	5·04	4·79
M'facturer's Profit £2 ꝑ ton	87·	80·	73·	68·	64·	60·	57·
	$3.60	$3.29	$3.03	$2.82	$2.64	$2.47	$2.35

PLANT DISEASES AND PESTS.

THE PINK DISEASE OF CACAO.

By James Birch Rorer,
Mycologist, Board of Agriculture.

HISTORICAL.

At rare intervals during the past seven years specimens of the pink disease of cacao have been found on several estates in the northern and eastern parts of Trinidad. The disease receives its name from the fact that the attacked branches, especially on the lower or shaded side, are covered with a pink incrustation, the fruiting stage of the fungus. This fungus has not proved a serious pest to cacao here, but in the East, on rubber, coffee and tea, considerable losses have been caused by what is now known to be the same fungus, so that any undue spread of it here should be quickly checked.

The pink disease has been known in the West Indies for a long time. The first specimens were found in Dominica by Stockdale (1) and referred to in a paper dealing with the fungous diseases of cacao, read at the West Indian Agricultural Conference held at Barbados, January, 1908, but the disease was not considered to be of a very serious character. Early in 1909, however, (2) several plots of cacao in St. Lucia were found to be quite badly affected by the same disease. The causative fungus was considered to be *Corticium lilacino-fuscum* Berk. and Curt. evidently having been identified at Kew.

Since these first records of pink disease in the West Indies, reference to it has been made in several books and papers dealing with the fungous diseases of cacao; it has generally been considered that the fungus itself does only little damage, but that the wounds caused by it form places of entrance for other fungi, notably the canker and die-back fungi.

More recently, South (3) refers to the disease in the West Indies. He states that the causative fungus was identified at Kew as *Corticium lilacino-fuscum* and that in St. Lucia it was found on pigeon peas as well as on cacao. He also states that the fungus resembles the allied species found on cacao in the East, and that there is the possibility of the two being identical, though the local fungus is of far less economic importance, and is apparently much more restricted in its range of host plants.

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(1) Stockdale, F. A. "Fungous diseases of cacao and sanitation of cacao orchards." *West Indian Bulletin*, IX, 1909, p. 166.

(2) "Pink disease of cacao in St. Lucia." *Agricultural News*, Barbados, VIII 1909, p. 260.

(3) South, F. W. "Fungous diseases of cacao." *West Indian Bulletin*, XII, 1912, p. 277.

Fawcett (1) reports a new fungous disease of cacao in Porto Rico which from the description is the same as the pink disease of Trinidad. It is said to be extremely parasitic and to occur also on grape fruit and coffee. Specimens were sent to the New York Botanical Gardens, but as no spores were present, a specific identification could not be made; the vegetative characters were however quite different from those of *Corticium lilacino-fuscum.*

During the past few years the pink disease has attracted considerable attention in the East since it has developed to be a serious pest on some Para rubber (Hevea) plantations in the Malay States, and on coffee estates in Java and other places.

Brooks and Sharples (2) who have recently studied the disease in the Malay States give an excellent review of the Eastern literature, so the references need not be repeated in this paper. They conclude that the causative fungus should be known as *Corticium salmonicolor* Berk. and Br. and agree with Rant that *Necator decretus* Massee is only a form of the same fungus. They point out that in many districts of the Malay States it is the disease that requires the greatest amount of attention. In some estates from 10 to 25 per cent. of the trees are attacked. In the East the fungus has been found on no less than 141 different species of plants including hibiscus, camphor, lime, durian, mango and jack-fruit, and causes serious diseases of coffee, rubber, tea and cinchona.

THE DISEASE IN THE WEST INDIES.

About eighteen months ago, Dr. Butler, Imperial Mycologist of India asked the writer for specimens of the West Indian pink disease for comparison with the Eastern form. Specimens were collected in the latter part of July, 1915 and forwarded to Dr. Butler who presented them to Kew. Miss Wakefield has reported upon them as follows:—

"PINK DISEASE OF CACAO FROM WEST INDIES."

"The specimens of West Indian 'Pink Disease' forwarded by Mr. Rorer are wrongly determined as *Corticium lilacino-fuscum.* I have compared them with *Corticum salmonicolor* B. et Br., and consider that they should be referred to this species.

"The West Indian specimens do not show the characteristic cracking of the hymenium quite so plainly as is usually the case in the Eastern forms, but in some of the specimens it is quite evident under the lens. No Necator stage is present in this material.

"With regard to the spore difference noted by Mr. Rorer in his letter to Dr. Butler, the spores are somewhat variable in width, but I have rarely seen them quite so narrow as Zimmermann figures and describes. They are usually more or less broadly pip-shaped or obovate.

"The spores resemble those of *C. roseum* Pers., but this species differs from *C. roseum* in its less fleshy consistency and in the much broader basal hyphæ."

(Sgd.) E. M. WAKEFIELD.

February 1, 1915."

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(1) Fawcett, G. L. "Cacao diseases." *Report of Porto Rico Agricultural Experiment Station* 1914, p. 29.

(2) Brooks and Sharples. "Pink disease of plantation rubber" *Annals of Applied Biology,* II, p. 58.

At the same time, through the kindness of Dr. F. Watts, Commissioner of the Imperial Department of Agriculture for the West Indies, specimens of the disease on lime twigs from Dominica were received. These specimens, together with some on cacao from Trinidad, were sent to Professor E. A. Burt of the Missouri Botanical Gardens. Professor Burt very kindly examined both specimens and compared them with material of *C. salmonicolor*, and agrees with Miss Wakefield as to the identity of the fungus. Extracts from his letters follow:—

"With regard to the pink disease, the specimens from Dominica (on lime) do not differ with regard to the fungus from the specimens which you have sent from Trinidad (on cacao). It seems that the pink disease is very probably caused by the same species of Corticium in both the Eastern Hemisphere and the Western. Yours is not caused by *Corticium lilacino-fuscum*."

"During the latter part of December, I received from Kew Herbarium, a specimen of *Corticium salmonicolor* B. and Br., collected in Ceylon by T. Petch, which agrees exactly in colour, cracked habit and all structural details with the specimens of 'pink disease fungus' which you sent me. A fragment of the authentic specimen of *Corticium salmonicolor* from Ceylon, determined by Berkeley, was also sent to me. Sectional preparations from this specimen are of exactly the same structure, spores, &c., as Petch's specimens and your collections.

"Miss Wakefield writes to me that she has studied the specimens which you sent to Kew and compared them with the Ceylon material of *Corticium salmonicolor*, and believes your specimens to be *C. salmonicolor*. I agree with her. *Corticium roseum* Pers. is the next thing to *C. salmonicolor*, but it has bushy branched paraphyses between its basidia; these paraphyses are often very conspicuous. I have found no paraphyses of this sort in the "pink disease" fungus. The absence of these paraphyses and the coarser hyphae of *C. salmonicolor* and the fact that *C. roseum* is strictly saprophytic wherever observed, show that these two fungi are distinct species."

From the above reports, it will be seen that the pink disease in the West and in the East are caused by the same species of fungus, namely, *Corticium salmonicolor* Berk. and Br.

SYMPTOMS.

The disease as it occurs on cacao is very characteristic, and cannot be mistaken. Branches from ½ to 1½ inches in diameter are most frequently attacked. The fungus gains entrances usually near the base of the branch, and then spreads with remarkable rapidity both up and down the stem. Small branches which are met with are quickly killed, and if the fungus reaches the forks of larger branches the whole crown may become affected. The leaves in affected branches wither, turn brown and fall to the ground. At about the time that the leaves show the first signs of something being wrong very fine silken. threads can be seen traversing the bark, and small whitish pustules are noticeable, especially at the lenticels. Eventually, as the leaves begin to turn brown, and drop, the affected branches, especially in the lower or shaded side, become covered with light-pink incrustation, which becomes slightly darker as it increases in thickness, (See Fig. 1).

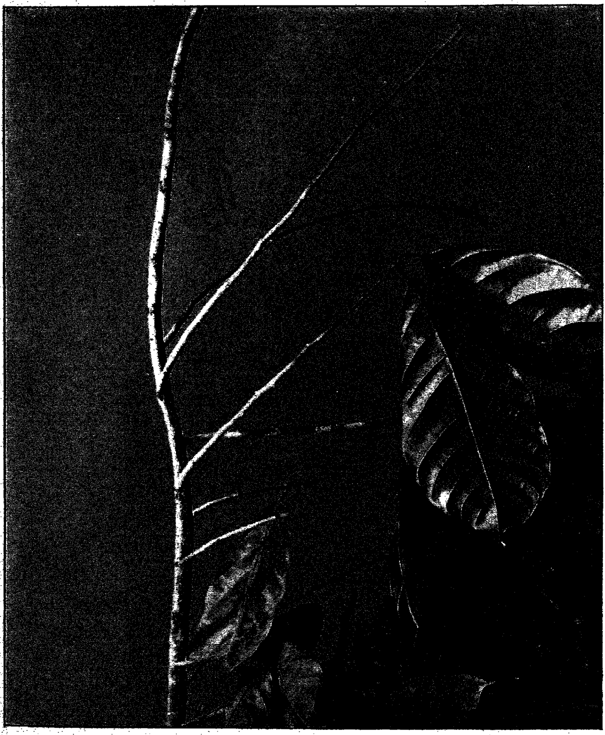

Fig. 1. Pink Disease of Cacao.

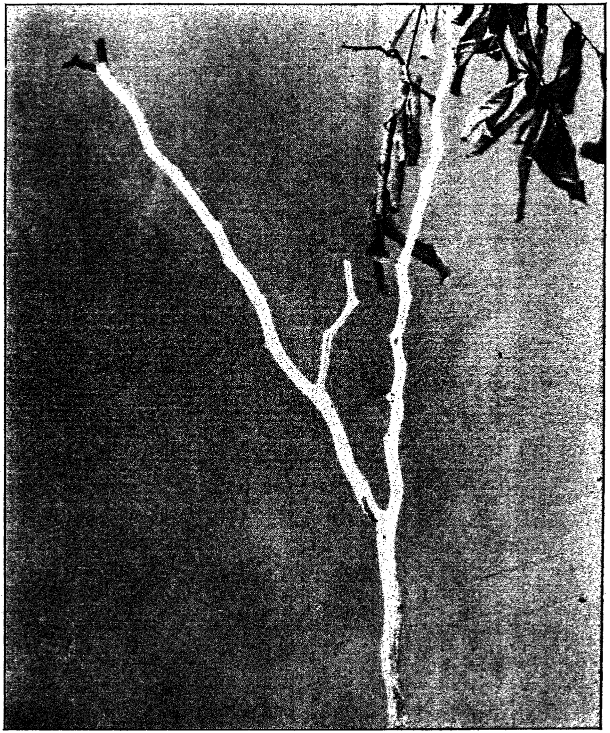

Fig. 2. Pink Disease of Amherstia.

This is the fruiting part of the fungus, and so far as the writer's observations go, is fairly rich in spores, though it is reported as being frequently sterile in Porto Rico and the Federated Malay States. Up to the present, the Necator stage has never been found in the West Indies. The fungus is extremely parasitic and spreads with great rapidity in wet weather but is immediately checked by a few dry days.

Recently, a beautiful specimen of the fungus on Amherstia has been sent to the laboratory by Miss Minerva Hart, who reports that it is doing considerable damage to the tree, which adds another host to the West Indian list. (Fig. 2.)

REMEDIAL MEASURES.

The treatment of the disease on cacao estates is very simple. Where it only occurs sporadically, the diseased branches should be cut out and immediately burned. If the diseased portions have to be carried out of the fields, they should be put in a bag to prevent the spores blowing about. If the disease should ever assume serious proportions, spraying with Bordeaux mixture or other fungicides would have to be resorted to. This is a comparatively simple matter on cacao estates, or even young (2 to 3 years old) Para rubber estates.

Where the disease has been found to be serious in old rubber estates, spraying is not recommended on account of the almost insurmountable difficulties in the way of spraying tall trees under estate conditions. The disease is best dealt with by cutting out and burning the affected parts where possible, or where only a small number of trees are attacked. Where larger number of trees are affected, good results have been obtained by treating the affected parts with tar, when the first signs of trouble are visible. Two applications, where necessary, at monthly intervals have given good results in the Federated Malay States.

The disease in Trinidad has so far never been found on rubber trees, but now that Para rubber (Hevea) is being planted up to a certain extent, and in some places, among cacao trees, a sharp look-out should be kept for the disease in the surrounding cacao, and every effort made to keep it from spreading to the rubber.

AGRICULTURAL LEGISLATION.

THE AGRICULTURAL FIRES ORDINANCE, 1915.

TRINIDAD AND TOBAGO.

No. 40.—1915.

I ASSENT,

[L.S.]

S. W. KNAGGS,
Acting Governor.

December 29, 1915.

An Ordinance relating to the regulation and prevention of Agricultural Fires.

December 29, 1915.

BE it enacted by the Governor of Trinidad and Tobago with the advice and consent of the Legislative Council thereof as follows:—

Short Title

1. This Ordinance may be cited as the Agricultural Fires Ordinance, 1915.

Interpretation.

2. In this Ordinance—

"Occupier" means the person having the immediate charge or management of any plantation or land, and includes an occupying owner, a tenant, contractor or cane farmer.

"Crop" means any growing crop, tree, wood, or under-wood or other produce of the soil, whether cultivated or not.

"Trash" means any megass, straw, brushwood, or other inflammable matter.

"Set fire to land" mean the setting fire to any crop or trash growing or being in or upon any land.

"Crown Lands" means any lands vested in His Majesty His Heirs or Successors.

"Clear days" shall be reckoned exclusive of the day on which any notice shall be given, and of the day on which any act mentioned in such notice shall be done.

Governor may prohibit setting fire to land.

3.—(1.) It shall be lawful for the Governor, by proclamation, to prohibit the setting of fire to land within such parts of the Colony and within such times to be specified in such proclamation as the Governor may see fit; and any person who, after the publication of and within the time specified in such proclamation, sets fire to any land within any part of the Colony mentioned in such proclamation, is liable to a penalty not exceeding fifty pounds or to imprisonment with or without hard labour, for any term not exceeding six months.

(2.) A proclamation under the preceding Sub-section shall be published in the *Royal Gazette* and shall take effect as from a date to be mentioned in such proclamation, and it shall be lawful for the Governor to issue such proclamation from time to time and to alter or revoke the same by proclamation in the *Royal Gazette*.

(3.) The production of a copy of the *Royal Gazette* containing any proclamation as aforesaid shall be *primâ facie* evidence in all courts and for all purposes whatever of the due making and tenor of such proclamation.

Procedure by person desiring to set fire.

4.—(1.) Every person desirous of setting fire to land shall:—

(*a.*) Cause an open space of at least 25 feet in width to be cleared round the land;

(*b.*) Cause all inflammable matter to be carefully removed from such space;

(*c.*) Give to the Warden of the Ward in which the land is situated a notice in writing specifying the local situation, extent and abuttals of the land;

(*d.*) Send to the Warden a certificate from a neighbouring land owner in the form in the Schedule hereto; and

(*e.*) If he is a contractor, cane farmer, or tenant send to the Warden the consent in writing of the person from whom he holds such land or the attorney, manager, assignee, or successor in title of such person.

(2.) Upon receiving the notice and certificate and also where required the consent in the preceding Sub-section mentioned, the Warden may in his absolute discretion either grant a license to set fire to the land or cause a further inspection to be made and a further certificate in a like form as aforesaid to be given by a competent person to be named by him before granting the license.

(3.) If any such certificate shall be false in any particular, the person who makes the same, or any applicant for a license who tenders, utters or puts off the same or any other false certificate is liable to a penalty not exceeding £50.

Form of license.

(4.) A license to set fire to land shall specify the period, not exceeding fourteen days at the most, within which such license shall be in force and the hours during which fire may be set. Provided always that no such day shall be a day prohibited by any proclamation of the Governor.

(5.) The powers conferred by this section on a Warden may be exercised by any person authorised by writing under the hand of the Warden so to exercise them.

Burning diseased trees, plants, etc.

5. Nothing in this Ordinance contained shall apply to setting fire to any cacao or coconut tree for the purpose of eradicating or preventing the dissemination of any disease or pest within the meaning of the Plant Protection Ordinance, 1911 or any Ordinance amending the same or extending the provisions thereof, or to setting fire to any tree, plant or growth in pursuance of an order of an Inspector appointed under the said Ordinance, or to setting fire to any tree, shrub, growth or underwood on any land which is being cleared for the construction of a railway under the provisions of the Railways Ordinance, No. 145, or for the construction or maintenance by the Public Works Department of any road under the provisions of the Roads Ordinances.

Notice to Police and to neighbours.

6.—(1.) Every person to whom a license shall be granted under this Ordinance, shall forty-eight hours at the least before fire shall be set to such land, serve or cause to be served on the Officer or Non-commissioned

Officer in charge of the Constabulary station nearest to such land, and on the occupiers of all lands adjoining the land in respect of which such license may be granted, a notice specifying the days on and the hours during which it is intended to set fire to such land.

(2.) In the case of land occupied by a tenant other than a tenant for years, or by a contractor or a cane farmer, the notice in the preceding Sub-section mentioned as being to be served on all occupiers of adjoining land shall be served upon the person of whom such tenant, contractor or cane farmer immediately holds, as well as upon such tenant, contractor or cane farmer.

Service of Notice.

7. Every such notice may be served on any owner by delivering the same to him in person, or by leaving the same at his residence on such adjoining land with some person actually residing therein, or if there be no such residence, or no person can be found therein, then by affixing such notice in some open and conspicuous place upon such adjoining land.

Fires to be watched.

8.—(1.) It shall be the duty—

(a.) Of every person whenever fire shall be set to any land under a license granted to him under this Ordinance;

(b.) Of every occupier of land whenever he has notice that any fire has come on to or is on his land;

so long as any fire shall be on any such land, to cause the same to be closely watched either by himself or by some responsible servant or agent to be by him appointed for such purpose, and it shall be the duty of such person or owner to use every endeavour by himself his servants and agents to extinguish any fire which may escape or extend from the land on which any fire shall have been set by him into any neighbouring lands or to extinguish any fire that may have come on to or be on his land.

(2.) Any person contravening the provisions of this section is liable to a penalty not exceeding Twenty Pounds.

Penalty for setting fire without license or notice.

9. Every person who

(a.) Sets fire to or procures, aids or abets the setting fire to, any land without a license under this Ordinance; or

(b.) Acts in contravention of the provisions of Section 6 of this Ordinance;

is liable to a penalty not exceeding £50.

Setting fire contrary to license.

10. If fire shall be set to any land in respect of which a license has been granted under this Ordinance at any time other than on the days or during the hours specified in the license, the occupier of the land is liable to a penalty not exceeding £10.

Proof of setting fire.

11. On the trial of any information for any offence under this Ordinance, proof of any crop or trash growing or being in or upon any land having been on fire shall be *primâ facie* evidence against the occupier of such land of such fire having been set thereto by such occupier or with his authority.

Charcoal pits.

12. It shall not be lawful for any person to open or use any pit on any land for the making of charcoal, without the license of the Warden of the Ward within which such pit shall be situate; and every such Warden

before granting any such license shall personally inspect or cause to be inspected by some competent person the place in which it is proposed to open or use such pit, and on such inspection, if he shall be of opinion that such pit may be used without danger of fire, may grant a license for the same; and every such license shall be and remain in force until the thirty-first day of December of the year in which such license may be granted.

Using charcoal pits without license.

13. Any person who shall open or use any pit for the making of charcoal without a sufficient license under this Ordinance in that behalf is liable to a penalty not exceeding Twenty Pounds, or to imprisonment for any term not exceeding three months, with or without hard labour.

Setting fire to Crown lands without authority.

14. Every person who shall wilfully set fire to any Crown lands except by virtue of an order in writing of the Warden of the Ward within which such lands may be situate, to be made under the authority of this Ordinance, is liable to a penalty not exceeding Fifty Pounds or to imprisonment with or without hard labour for any term not exceeding six months.

Warden may order firing of Crown lands.

15. It shall be lawful for the Warden of any Ward within which any Crown lands may be situate, by an order in writing under his hand, to make order for the setting of fire to any such land on any day, not being a day prohibited by any proclamation of the Governor; and public notice of such order having been made shall be given by affixing copies of such Order in some open and conspicuous part of the several Constabulary stations within the several Wards within which such land or any part thereof may be situate, at least ten clear days before the first day to be appointed in or by such order for setting fire to such land: Provided always that no such order for setting fire to any Crown lands shall be made in any case, where the Sub-Intendant of Crown Lands shall prohibit the making thereof.

Carrying lighted torch, &c.

16. Every person who carries any lighted torch or other matter in a state of ignition, not sufficiently enclosed so as to prevent danger from fire, in or upon any public road or any Crown lands, is liable to a penalty not exceeding Five Pounds.

Smoking, &c., on plantation.

17. Every person who smokes upon any plantation save and except within a dwelling house, or carries any lighted torch or other matter in a state of ignition not sufficiently enclosed so as to prevent danger from fire upon any plantation, is liable to a penalty not exceeding Five Pounds.

Power to enter land and [illegible] extinguish fire.

18.—(1.) Where a fire has broken out on any land, the Warden of the Ward in which such land is situate or any of his Ward Officers or any Commissioned or Non-commissioned Officer of Constabulary may if he thinks fit enter upon the land where such fire may be, and upon any land to which there may be reasonable cause of apprehension that such fire may spread, and do all such matters and things as such Warden or Officer shall reasonably deem to be necessary for the purpose of extinguishing such fire or preventing the growth and spreading thereof.

Persons present may be called upon to assist.

(2) Such Warden or Officer may also if necessary call upon and require every male person who is at the time within a reasonable distance of any such fire to be aiding and assisting in the extinction of such fire; and any such person who after being so called upon and required shall refuse or fail to be aiding or assisting as he may be directed by such Warden or

Officer as aforesaid is liable to a penalty not exceeding Five Pounds, unless he proves to the satisfaction of the Magistrate that at the time of such fire he was under the age of fourteen years or above the age of sixty years, or was prevented by bodily sickness or infirmity from being so aiding and assisting.

(3.) The fact that any such Warden or Officer has called upon and required any male person to be aiding and assisting in the extinction of any such fire shall be conclusive for all purposes that the person so called upon and required was at such time as aforesaid within a reasonable distance of the fire.

Who may recover penalties.

19.—(1.) All offences under this Ordinance may be prosecuted before a Magistrate in the manner laid down in the Summary Conviction Offences (Procedure) Ordinance, No. 1.

(2.) All offences under Section 17 hereof may be prosecuted on the information of the occupier of the plantation or land on which the offence shall have been committed. All other offences under this Ordinance may be prosecuted on the information of any person.

Appropriation.

20. All penalties recovered under this Ordinance shall be paid into the Colonial Treasury for the use of His Majesty the King.

Reward to informer.

21. Notwithstanding the provisions of Section 20 of this Ordinance, the Governor in Executive Council may award and direct payment by the Receiver-General to any person or persons who has or have given information leading to the recovery of any penalty, such portion, not exceeding a moiety in the aggregate, as he may think proper.

This section shall be in force only at such times and in such districts as the Governor may from time to time prescribe by proclamation to be published in the *Royal Gazette*.

Imprisonment in default of payment of penalty.

22. If any person is convicted of any offence under Sections 4, 8, 9, 10, 16, 17, and 18, of this Ordinance, and makes default in the payment of any penalty imposed by such conviction, every such person shall be imprisoned either with or without hard labour for any term not exceeding six months.

Liability for damage caused by fire.

23. Nothing in this Ordinance contained shall take away or diminish the liability of any person for any damage from fire caused by the act or neglect of such person or his servant.

Port-of-Spain, San Fernando and Arima.

24. Nothing in this Ordinance contained shall extend to the City of Port-of-Spain as defined, from time to time under the provisions of the Port-of-Spain Corporation Ordinance, 1914, or the Boroughs of San Fernando or Arima.

Repeal.

25. The Ordinances Nos. 6 of 1910 and 5 of 1912 are hereby repealed.

Passed in Council this Seventeenth day of December, in the year of Our Lord one thousand nine hundred and fifteen.

J. M. FARFAN,
Acting Clerk of the Council.

Schedule.

FORM OF CERTIFICATE.

Section 4.

I of in the Ward of land owner (*or* the person named by Warden of the Ward of to make the inspection required by Section 4 of the Agricultural Fires Ordinance, 1915) hereby certify as follows:—

(1.) I personally inspected on the day of the land to which of is desirous of setting fire.

(2.) The local situation, extent and abuttals of the land are:—

(*a.*) Local situation—(*here set out particulars.*)

(*b.*) Extent—(here set out area.)

(*c.*) Abuttals.

(3.) The said has caused an open space of at least 25 feet—to wit feet in width to be cleared all round the said land and has carefully removed all inflammable matter from such space.

(Signed)

N.B.—The person giving or uttering a certificate false in any particular is liable to a penalty not exceeding £50 and in default of payment to imprisonment with or without hard labour for a term not exceeding six months.

AGRICULTURAL EDUCATION.

CACAO PRIZE COMPETITION.

Brasso Piparo District.

REPORT OF THE JUDGES.

JUDGING began on December 10, 1915, at Todd's Road and was completed on December 17 at Piparo. During that time we visited the holdings of eight Peasant Proprietors and eight Contractors selected by the Agricultural Inspector as the best among the 218, and 171 entries in their respective classes.

The following are the results:—

CLASS I. PEASANT PROPRIETORS.

Order.	Names.	Nationality.	Marks.	Prize.
1	Nagina ...	... East Indian ...	97	$80.00
2	J. West ...	... Trinidadian ...	94	60.00
3	E. Mota ...	... Spanish Trinidadian ...	87	40.00
4	C. L. Legendre	... Trinidadian ...	83	30.00
5	Ed. Nicholas...	... ,, ...	74	20.00
6	Ramjohn ...	... East Indian ...	69	...
7	Peter Ramsaroop	... ,, ...	64	...
8	Ed. Hall ...	... Grenadian ...	62	...

CLASS II. CONTRACTORS.

Order.	Names.	Nationality.	Marks.	Prize.
1	Clifford Worrell ...	Barbadian ...	96	$60.00
2	Banwarrie (Bonawa) ...	East Indian ..	91	45.00
3	Byron Bristol ...	Grenadian ...	90	30.00
4	Willie Jules	Trinidadian ...	82	20.00
5	H. Legendre... ...	,, ...	81	15.00
6	Phoolbassia	East Indian ...	70	10.00
7	Chas. Welcome ...	Trinidadian ...	58	5.00
8	John Archer... ...	,, ...	57	...

We have much pleasure in recommending that the above prizes be awarded.

The details of marking are shown on the score cards accompanying this report, (1) and need not again be given, but the following analysis of the marks of the prize winners gives much useful information.

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(1) Not printed.

Analysis of Marks.

Names.	Nationality.	Draining.	Forking.	Manuring.	Systematic in Cultivation.	Total for Cultivation.	Preventative.	Remedial.	Systematic in Sanitation.	Total for Sanitation.	General.	Grand Total.
CLASS I.—PEASANT PROPRIETORS.												
Nagina	East Indian	20	10	10	10	50	9	9	9	27	20	97
J. West	Trinidadian	20	10	10	10	50	8	8	8	24	20	94
Eloi Mota	Spanish-Trinidadian ...	19	8	7	9	43	8	8	9	25	19	87
C. L. Legendre	Trinidadian	18	8	9	8	43	7	7	7	21	19	83
Edward Nicholas	Trinidadian	17	8	7	7	39	7	6	7	20	15	74
Averages for Peasant Proprietors		18·8	8·8	8·6	8·8	45·	7·8	7·6	8·	23·4	18·6	87
CLASS II.—CONTRACTORS.												
Clifford Worrell	Barbadian	20	9	9	10	48	10	9	10	29	19	96
Banwarie	East Indian	19	9	10	9	47	9	8	8	25	19	91
Byron Bristol	Grenadian	18	9	9	9	45	8	9	9	26	19	90
W. Jules	Trinidadian	18	8	9	9	44	7	7	7	21	17	82
Helena Legendre	Trinidadian	18	8	7	8	41	8	7	8	23	17	81
Phoolbassia	East Indian	17	6	6	7	36	6	6	6	18	16	70
Chs. Welcome	Trinidadian	12	7	6	7	32	5	5	5	15	11	58
Averages for Contractors		17·45	8	8	8·42	41·85	7·56	7·28	7·56	22·42	16·85	81·15
General Averages both Classes		18	8·33	8·25	8·58	43·16	7·66	7·41	7·75	22·82	17·58	83·58

From the above we take the following —

Two competitors	obtained	full marks	for	cultivation work in general.
Three	,,	,,	,,	draining.
Two	,,	,,	,,	manuring.
Three	,,	,,	,,	systematic cultivation.
One	,,	,,	,,	preventative measures taken against disease.
One	,,	,,	,,	systematic work in tree sanitation.
Two	,,	,,	,,	general work as distinct from the above.

The average percentages for the different kinds of work done are excellent and are as follows for both classes:—

	Per cent.
Draining	90
Forking	80·25
Manuring	80·25
Systematic cultivation	80·5
Preventative	70·5
Remedial	70·5
General work (apart from above)	81

The general average of all the prize winners for all classes of work is 83·58 per cent. Of the twelve competitors under review five have obtained 90 per cent. and over, of all the marks obtainable; one indeed Nagina, a peasant proprietor reaching 97 per cent.

Of the two classes the five prize winning peasant proprietors with 87 per cent. of possible marks show a slight advantage over the contractors' class where the seven prize winners have obtained an average of 81 per cent. If, however, the five best in each class are taken the contractors would have pride of place with an average of 88 per cent. Although the averages for sanitation, principally arboricultural work, are all over the 70 per cent. mark, and can in no way be considered indifferent, yet it is to be noted that the marks obtained under tillage are well in advance of them. As tillage is undoubtedly the more important of the two and indeed is the principal remedial measure in attacking backward fields, it is only natural that the results should be as given, one year only being allowed to complete all work, a difficult thing for men of limited time and means.

NOTES ON THE SUCCESSFUL COMPETITORS.

Nagina: The first prize in the Peasant Proprietors' Class goes this year to an East Indian of local birth and education. It is the first time an East Indian has held that distinction and Nagina is to be congratulated; he has had a hard task with indifferent land, and he has had to obtain high marks—97 to beat J. West the second prize winner's 94.

West struck one as being the typical happy small proprietor with his well-worked land, comfortable little cottage and well kept stock; neat surroundings and careful attention to details.

Eloi Mota, a representative of the Spanish working class, did well with 87, and it is interesting to record that he almost bounds with a previous first prize winner, G. L. Payson, and is a near neighbour of Cleto M. Hospedales the third prize winner in 1913-14; had he not been ill during four months this year, those preceding him on the prize list might have had to take lower places.

Charles Leopold Legendre's work may be described as being evenly distributed though not perfect in any single branch, it is nevertheless well done.

Edward Nicholas the winner of the fifth and last prize is nine points below Legendre's 83. His 74 marks indicate that lack of detailed attention often observable when other occupations share the same man's time. He is a cane farmer and store porter as well as a cacao planter.

In Class II, Clifford Worrell, a Barbadian, is first with 96 marks obtaining full marks for drainage, preventative and systematic work; an assiduous and intelligent follower of the Inspector's instructions and a devoted worker, it is easy to understand the reason of his capturing the first prize.

Banwarrie (Bonawa) an East Indian (though of Trinidad birth and training) is fully deserving with 91 marks of the second prize. Indifferent land forced to do what is required of it, aptly describes his work. He deserves great credit for the excellence of his mulching work, the material for which he collected at great pains.

Byron Bristol "Grenadian born but Trinidad bred" to use his own term, with 90 marks obtains third prize. Rather handicapped by the size of his contract, bought in an abandoned condition from a neglectful contractor two years ago, he has accomplished much. His score card shows no item neglected, losing one mark each under six headings, and two marks each under two others, it proves the well balanced nature of his work.

William Jules the winner of the fourth prize with 82 marks has had an uphill fight. He has tried before, but undeterred by failure, soil and landslides, has persevered and won.

Helena Legendre with 81 and Phoolbassia with 70 marks came fifth and sixth respectively. Both are contractors on lands of Mr. Laddie Legendre, and though deserving of great credit, it must be admitted they were greatly assisted by an intelligent and indulgent master.

Charles Welcome the winner of the seventh and last prize in the Contractors' Class, has not quite obtained 60 marks. He probably would have done better, had he not, according to his statement, been prevented by the proprietor from carrying out all the instructions given him. Welcome showed in oral examination adequate knowledge, and his wish to follow the instructions of the Inspector is proved by the care exercised in the preparation of manure by the admixture of poultry droppings with a proportion of sifted soil and its conservation from the weather until required.

GENERAL.

The rapidly reducing marks shown on the score cards of other competitors not on the prize list may be satisfactorily accounted for by the large district under the care of the Inspector, and again, in the excessive number of entries, 423 to all the competitions held this year, making it impossible for the Inspector to visit each competitor as frequently as might have been necessary.

All competitors were submitted to a searching oral examination, and we are pleased to report that their answers were most creditable; proving that where their work is not quite complete, they are perfectly able to continue it, and having the further opportunity of perfecting their knowledge by entering the "Special Competition" for prize winners next year, they should at the termination of the second year's work, not only have their holdings in perfect order, but be fit man for such posts as estate drivers, overseers, or expert workmen, and it is hoped that estate owners will encourage this practical educative movement by giving precedence to a man holding the Board's Certificate.

(Sgd.) A. B. CARR,
J. C. AUGUSTUS,
FERNAND T. FARFAN, } Judges.

December 6, 1915.

VISIT OF THE TOBAGO PLANTERS' ASSOCIATION.

It was decided at a meeting of the Board of Agriculture on December 15, 1915, to invite ten or twelve members of the Tobago Planters' Association to visit Trinidad. The dates from March 17 to 21, were selected, as the Agricultural Exhibition would be held at that time and the sugar crop would be in full swing. The arrangements for the visit were put into the hands of a Committee made up of Sir Townsend Fenwick, K.C.M.G. (Chairman), Hon. Sir Norman Lamont, Bart., Hon. W. G. Kay, Messrs. C. de Verteuil, J. J. McLeod, C. Forbes Todd, C. S. Rogers, W. Greig, and J. B. Rorer.

The Tobago Planters' Association agreed that the dates selected would be most suitable for the visit, and the following members reached Trinidad on Friday March 17, at about 3.30 p.m.:—

Capt. M. Short, Messrs. D. Macgillivray, H. R. Hamilton, H. H. Tucker, J. B. Murray, E. J. H. Thomas, E. C. C. Sealey, R. B. Archibald, J. C. Shaw, and J. W. Pitcairn.

The following Honorary members also came over:—

Messrs. J. Strange, and G. Grey. Messrs. A. A. Cipriani and T. E. Miller, Honorary members residing in Port-of-Spain also received invitations for the various excursions.

Some of the members visited the Agricultural Show on Friday afternoon. On Saturday the party went to River Estate and were taken through the experimental plots there, and had luncheon with Professor Carmody. On Saturday afternoon, many visited the Agricultural Show. Most had made arrangements to visit friends on Sunday, but Professor Carmody entertained some at breakfast and Mr. Urich took three for a motor drive through Maraval and Petit Valley and visited Mr. Lazare's citrus orchard.

At the kind invitation of Mr. C. Forbes Todd, the Usine Ste. Madeleine was visited on Monday. The General Manager of the Railway put a special carriage at the disposal of the Board but His Excellency the Governor invited the members to make the trip to the Usine with him in his private car. Mr. Todd had a locomotive at Corinth, where the car was detached from the regular train and taken right to the factory. Several members motored from Couva to the Usine with Messrs. C. de Verteuil and J. d'Abadie. After going through the factory, all the visitors were the guests of Mr. Todd to breakfast. Some of the members motored to town, while the others came back by train.

A dinner was given by the Board of Agriculture in the evening, at the Queen's Park Hotel. The Director of Agriculture presided, as His Excellency the Governor, President of the Board was unable to attend. All the visitors were present, and the following members of the Board :—Hon. Sir Norman Lamont, Bart., Hon. Sir Townsend Fenwick, K.C.M.G., Hon. R. S. A. Warner, K.C., Messrs. W. G. Freeman, J. d'Abadie, J. J. McLeod, J. W. Arbuckle, P. I. Cox, A. B. Carr, C. S. Rogers, J. B. Rorer and F. W. Urich.

The following invited guests were also present :—Hon. Adam Smith C.M.G., Hon. Secretary of the Chamber of Commerce, Messrs. Wm. Gordon Gordon, President of the Chamber of Commerce, Major Boosé, C.M.G., Travelling Commissioner of the Royal Colonial Institute, and Edgar Tripp Secretary of the Agricultural Society.

The following were the toasts :—His Majesty the King. The Tobago Planters, proposed by Professor Carmody, seconded by Mr. A. B. Carr and responded to by Mr. J. W. Pitcairn, Honarary Secretary Tobago Planters' Association. The Board of Agriculture, proposed by Capt. Short, seconded by Mr. R. Bruce Archibald and responded to by Hon. R. S. A. Warner, and the Chairman, proposed by Mr. Strange, Commissioner-Warden of Tobago.

On Tuesday, the party visited St. Augustine Estate and the Government Farm and were entertained to breakfast by Professor Carmody at his house. The visitors left in the evening at 8 p.m. for Tobago.

BOTANICAL.

ORCHIDS IN THE ROYAL BOTANIC GARDENS.

Species in Flower, January to December, 1915.

Each month during which a species has been in flower is indicated by a x in the corresponding column.

Name.	January	February	March	April	May	June	July	August	September	October	November	December
1. *Acampe ?*											x	
2. *Aërides ordoratum* Lour							x			x		
3. *Bifrenaria aurantiaca* Lindl.		x	x									
4. *Bletia alta* (L.) Hitchc.		x	x		x	x						
5. *Brassia caudata* Lindl.	x											x
6. *Brassavola nodosa* (L.) Lindl.	x	x							x	x	x	x
7. *Bulbophyllum pachyrachis* (A. Rich.) Griseb		x										
8. *Camaridium ochrolecuum* Lindl							x	x	x			
9. *Catasetum macrocarpum* L. C. Rich.			x	x					x		x	
10. *Cattleya labiata* Lindl. (C. Gigas) var. Sanderiana				x								
11. *C.* *labiata* Lindl. var. Gaskelliana *Hort Sander*		x										
12. *C.* *Schroederiana* Rchb. f.				x								
13. *C.* *Skinneri* Lindl. var. *parviflora* Hook	x	x										
14. *Coelogyne pandurata* Lindl.	x						x				x	
15. *Coelogyne* sp.			x	x	x	x						
16. *Coryanthes macrantha* Hook										x		
17. *Cyrtopera longifolia* (Kunth) Rchb. f.			x									
18. *Cyrtopodium cristatum* Lindl.			x									
19. *Dendrobium* sp. (Flowers white, lasting but a few hours!)		x					x	x	x	x		
20. *D.* sp.					x	x						
21. *D.* *aggregatum* Roxb.			x									
22. *D.* *fimbriatum* Hook. var. oculatum				x	x	x						
23. *D.* *moschatum* Sw.					x			x				
24. *D.* *Pierardi* Roxb.	x		x								x	x
25. *D.* *sanguinolentum* Lindl.	x	x				x		x	x	x	x	x
26. *Diacrium bicornutum* (Hook.) Benth.	x	x	x									
27. *D.* " " " var. *indivisum* Cogn			x									
28. *Dichaea graminoides* (Sw.) Lindl.	x				x	x		x				
29. *Epidendrum atropurpureum* Willd		x	x									
30. *E.* *ciliare* L.	x				x		x	x		x	x	x
31. *E.* *fragrans* Sw.			x	x	x							
32. *E.* *globosum* Jacq.	x	x										x
33. *E.* *Ottonis* Reichb. f.	x										x	x
34. *E.* *patens* Sw.					x							

Orchids in the Royal Botanic Gardens.—*(Continued.)*

Name.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
35. *Epidendrum rigidum* Jacq.	...	x	...	...	...	...		...	...	...	...	...
36. *E. stenopetalum* Hook.	...	x	...	...	...	...	...	...	...	...	...	...
37. *E. strobiliferum* Rchb. f.	...	x	...	...	...	...	...	...	...	...	...	...
38. *Epistephium parviflorum* Lindl.	...	...	x	...	...	...	...	...	...	...	...	...
39. *Gongora quinquenervis* Ruiz. et Pav. (*G. maculata* Lindl.)	x	x	x	x	x	x	x	x	x	x	x	x
40. *Ionopsis utricularioides* (Sw.) Lindl.	...	x	x	x	x	x	...	...	...	...	...	...
41. *Lockhartia acuta* (Lindl.) Rchb. f.	x	x	x	...	...	...	...	...	x	x	x	x
42. *L. elegans* Hook.	x	x	...	...	...	...	...	...	...	...	...	...
43. *Maxillaria rufescens* Lindl.	...	x	x	x	x	x	x	...	...	...	...	...
44. *Oncidium altissimum* (Jacq.) Sw.	...	...	...	...	...	...	...	...	...	x	x	...
45. *Oncidium ampliatum* Lindl.	x	x	x	x	x	...	...	...	...	...	...	x
46. *O. Cebolleta* (Jacq.) Sw.	x	...	...	...	...	...	...		...	...	...	...
47. *O. guttatum* (L.) Rchb. f.	...	x	x	x	x	x	...	x	...	...	...	...
48. *O. hæmatochilum* Lindl.	...	...	...	...	...		...	x	...	...	...	...
49. *O. Lanceanum* Lindl. "Cedros bee"	x	x	x	x	x	x	...	...	...	x	x	x
50. *O. papilio* Lindl. "Butterfly orchid"	x	x	x	x	x	x	x	x	x	x	x	x
51. *O. pusillum* (L.) Rchb. f.	x	x	x	x	x	x	x	x	x	x	x	x
52. *Ornithocephalus gladiatus* Hook	...	x	x	x	x	...	...	...	...	...	...	...
53. *Paphinia cristata* Lindl.	...	...	...	...	x	x	x	x	x	x	...	...
54. *Pleurothallis leptopetala* Cogn. (n. sp.?)	x	x	x	x	x	x	...	...	...	...	...	...
55. *P. pruinosa* Lindl.		x	x	x	...	...	...	...	...	...	...	...
56. *P. sertularioides* (Sw.) Spreng. var. B. *trinitensis* Griseb.	...	...	x	x	...	...	...	...	...	...	...	...
57. *P.* sp.	...	x	...	...	...	...	...	...	...	...	...	...
58. *P.* sp.	...	x	...	...	...	...	...	...	...	...	...	...
59. *Rhynchostylis violacea* Reichb. f.	...	...	...	...	...	...	...	x	...	...	...	...
60. *Rodriguezia secunda* Kunth	...	x	x	x	x	x	...	...	...	x	...	...
61. *Scaphyglottis prolifera* (R. Br.) Cogn	x	...	x	x	...	...	...	...	...	...	...	x
62. *Schomburgkia Humboldtii* Rchb. f.	...		x	...	...	...	...	...		...	...	...
63. *Sobralia* sp. (*terrestrial*)	...	x	...	...	...	...	...	...	...	...	...	...
64. *Spiranthes acaulis* (Smith) Cogn. (*S. picta* Lindl.)	x	x	...	...	...	...	...	...	...	...	...	...
65. *S. guianensis* (Lindl.) Cogn (*S. Hostmanni* Rchb. f.)	...	...	...	...	x	...	...	...	...	...	...	...
66. *Stanhopea grandiflora* Lindl. +	x	...	...	...	...	...	...	x	x	x	x	x
67. *Stauropsis* sp.	...	...	...	...	...	...	...	...	...	...	...	...
68. *Stelis ophioglossoides* (Jacq.) Sw.	...	...	...	...	x	x	...	...	...	x	...	...
69. *Stenia pallida* Lindl.	...	...	...		x	x	x	...	...	...	...	...
70. *Stenorrhynchus orchioides* (Sw.) L. C. Rich.	...	...	x	x	...	...	...	...	...	...	...	...
71. *Trizeuxis falcata* Lindl.	...	x	x	x	x	x	...	...	...	...	...	...
72. *Vanda teres* Lindl.	...	...	...	x	x	...	...	...	...	...	...	...
73. *V. tricolor* Lindl.	x	x	x	...	...	...	...	...	...	...	...	...
74. *Vanilla Hartii* Rolfe	...	...	x	x	...	...	...	...	...	...	...	...
75. *V. phæantha* Rchb. f.	...	...	x	x	...	...	...	...	...	...	...	...

W. E. BROADWAY.

ODONTADENIA SPECIOSA.

The following interesting note on one of the beautiful native plants of the Colony is taken from *The Field* for November 20, 1915, Vol. CXXVI, page 879, where it was accompanied by an illustration. In *The Field* the plant is referred to as *O. Harrisii* but it is correctly known by the earlier name *O. speciosa*. In the *Bulletin* of the Trinidad Botanical Department (the forerunner of this *Bulletin*) Vol. V. 1903 p. 512 there is a reference to the fact that this beautiful climber was introduced into England in 1854 from the Trinidad Royal Botanic Gardens by Mr. Purdie, then Government Botanist. It is a free flowerer and is readily propagated by layers. It occurs wild in the Colony at Nariva, Caroni and Caparo. Mr. J. H. Hart showed that it yielded a small amount of rubber of fairly good quality.

"Readers of the *Field* will be delighted to learn that one of our loveliest tropical climbing plants was named in compliment to the father of the present Lord Harris, a former Governor of Trinidad, where it was discovered about sixty years ago, shortly afterwards becoming an established favourite with growers of tropical plants in this country. At that time it was known as Lord Harris's Dipladenia, and as every gardener knows, the dipladenias rank with the aristocracy among stove plants, though they are not now in such favour as they used to be, when there were as many stove greenhouses in this country filled, with choice selections of tropical plants, as there are garages to-day. The dipladenias, allamandas, bignonias, aristolochias, passifloras, and other once popular creepers from the tropics do still find a home in the stoves at Kew, where Lord Harris's plant may be seen every summer hanging in festoons over the *Victoria regia* lily and flowering with the freedom of a bindweed. The name has been changed to Odontadenia because of the toothed corona-like ring at the base of the trumpet, which is not present in true dipladenias; and there are other differences. For example, Lord Harris's plant has leaves a foot long and 4in. wide, on stems that grow as vigorously almost as a grape vine. Its flowers are 4in. across, glossy yellow streaked inside the tube, and tinged at the base of the lobes with crimson, and they are deliciously fragrant. Here is a climber for a big tropical conservatory in this country, and for big effects out of doors in countries where it would thrive in the open. We can imagine it clothing the ruins of a building with a wealth of foliage and beautiful fragrant flowers for it appears to be as good-natured as a Virginian creeper or a tropical liana. It would be a most suitable climber for clothing a verandah or garden shelter in those parts of the British Empire where iced drinks are more in demand than fires, and the cool of the evening is the best part of the day."

FORESTRY.

NOTES ON DIRECT SOWING OF SEEDS OF TIMBER TREES IN PLANTATIONS.

By C. S. Rogers,
Forest Officer, Trinidad and Tobago.

Timber trees grown from seeds at the spot where they are to remain, will, as a rule, flourish better, and produce finer timber than those that have been transplanted from nurseries or from the forests, and for this reason, it is recommended that seeds of Cedar (*Cedrela odorata*), Cypre (*Cordia Gerascanthus*), Balsam (*Copaifera officinalis*), Locust (*Hymenœa Courbaril*), and Teak (*Tectona grandis*) should be sown at stake or picket, it would however be better as a general rule to supply vacancies, due to failure of seeds, with young transplants than to wait another year.

To ensure a good stand, not less than five seeds of Cedar, Cypre or Teak should be sown at each picket; with Balsam or Locust, two seeds will as a rule, be sufficient. The seeds should be evenly distributed round the picket and about six inches from it. When more than one plant results, the surplus can then be used as transplants to supply vacancies without injury to the plant left.

The planting spots should be about 3 feet across and thoroughly cleared of all weeds, and the soil broken up fine.

Small seeds such as Cedar and Cypre should be covered with not more than half an inch of fine soil; Balsam, Teak and Locust seeds may be planted a little deeper.

Seeds sown in the position in which they would naturally lie if dropped on the ground, give the best results.

It is of great importance that small seeds such as Cedar and Cypre should be sown when quite fresh, they quickly lose their power to grow if allowed to get too dry. It has been found that 80 to 95 per cent. of Cedar seeds will germinate if sown within a month of collection, in moist soil. Three months after collection, 75 per cent. were found to germinate, but after six months they would probably be worthless.

Cypre seeds that were sown five seeds to a picket as soon as collected in the year 1911 produced 90 per cent. success.

Some of these have given trees up to 45 feet high in 4½ years and up to 24 inches in girth. One month after collection, only 46 per cent. germinated. At three months, they would probably be useless, our experience is, that some years a far lower percentage of the Cypre seed is good, and in some years not more than five per cent. of success has been obtained from the first sowing.

Balsam and Locust seeds will keep for two or three months, but give best results if sown when fresh.

Teak seeds, will, as a rule, germinate better when one year old than when quite fresh, and it has been found that if sown when quite fresh a far larger proportion will come up in the second year than in the first.

In all sowings at stake or picket, it is recommended that the planting spot should be prepared two or three weeks before the actual sowing.

This gives an opportunity for wild creatures to satisfy their curiosity regarding the newly upturned ground without damaging the seeds as they begin to germinate, and also probably tends to the destruction of harmful insects and grubs.

Three to five weeks after the first sowing, a second sowing should be made at the pickets at which no plants have resulted. If this second sowing fails other species should be sown; the failure may be due to bad seed, or to destruction by wild creatures.

In addition to re-sowing, one nursery should be made to each two acres sown. If the nurseries are scattered about the area, the cost of transporting the transplants used as supplies is reduced. These nurseries should be sown at the same time as the sowing at stake is done. The nursery beds may be of any convenient length but not more than two feet wide to make any necessary weeding easier. If the seeds are sown about six inches apart there will be no need to transplant them till they are required for supplying, and each plant can be taken out with a ball of earth.

A distance of 10 ft. by 10 feet is recommended for a timber plantation for, although the trees cannot grow to full maturity so close together, they will be forced to form straight trunks, and thinning can be made as necessary.

Cedar has been found to do better if the land to be planted is first burnt as is usual in cacao cultivation, and for Teak this is considered necessary. Cypre has been grown sucessfully where fire was not used.

If the nurseries are on Forest land, the bush cut down should also be burnt on it before the nursery beds are made.

Crown Lands Office,
Port-of-Spain,
March 28, 1916.

LIVE STOCK.

GOVERNMENT FARM ANNUAL SALE.

The thirty-third annual sale of surplus stock of the Government Farm, Trinidad took place on February 23, 1916. The range of prices and the averages in the various classes were as follows :—

Class.	Number sold.	Range of Prices.	Average. Prices.
		$ c. $ c.	$ c.
Pure Bred Zebu Bulls	4	150.00–220.00	187.50
„ „ Cows... ...	2	44.00– 49.00	46.50
„ „ Heifers ...	3	55.00– 58.00	56.33
Half Bred Zebu Bulls... ...	8	31.00– 72.00	49.00
„ „ Cows... ...	4	35.00– 51.00	45.00
„ „ Heifers ...	5	36.00– 46.00	41.00
„ Holstein Bulls ...	5	33.00– 34.00	29.0
„ „ Heifers ...	5	36.00– 46.00	42.00
„ Jersey Bulls ...	4	24.00– 56.00	34.00
„ Shorthorn Bulls ...	6	29.00– 81.00	56.33
„ „ Heifers ...	11	35.00– 69.00	53.00
„ Guernsey Heifers ...	3	36.00 - 50.00	41·00
„ „ Cows ...	2	38.00– 50.00	44.00
Working Oxen	4 (pairs)	175.00–191.00	184.00 (per pair).
Pigs	12	3.50– 4.80	4.14
Poultry	10 *	5.00– 10.00	8.60 (per lot).

The total receipts from the sale were $4,273.38

Less commission and expenses 261.74

Nett $4,011.64

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* 6 Trios, 3 Coops of 4 hens each, 1 Trio ducks.

METEOROLOGY.

RAINFALL RETURN FOR FEBRUARY, 1916.

Stations.	February, 1916.	February, 1915.	Jany. and Feb., 1916.	Jany. and Feb., 1915.
North-west District.	Ins.	Ins.	Ins.	Ins.
St. Clair—Royal Botanic Gardeus	1·35	0·66	6·64	2·76
Port-of-Spain—Colonial Hospital	0·56	0·27	3·38	1·62
,, Royal Gaol	0·90	0·45	4·59	2·43
,, Constabulary Hdqr's.	0·87	...	...	...
St. Ann's—Reservoir	1·16	0·43	5·97	4·18
Maraval— ,,	3·25	0·88	9·53	3·17
,, Constabulary Station	2·73	0·03	9·45	2·46
Diego Martin—Constabulary Station	2·15	0·70	9·15	2·92
,, Waterworks	2·57	1·11	9·14	3·03
,, River estate	2·74	1·04	8·99	2·88
Fort George Signal Station	1·75	0·25	7·21	2·67
North Post ,,	1·53	0·22	7·19	1·45
Carenage Constabulary Station	2·02	0·34	9·16	2·52
Carrera Island Convict Depôt	0·65	0·11	5·72	0·70
Chacachacare Lighthouse	0·90	0·44	5·06	2·19
Santa Cruz—Maracas District.				
Santa Cruz—Constabulary Station	1·94	0·24	9·32	2·60
St. Joseph—Government Farm	1·93	0·23	5·87	2·73
,, Constabulary Station	1·19	0·03	3·91	2·42
Tunapuna—St. Augustine estate	2·09	0·48	5·06	2·57
Maracas—Government School	2·35	Nil	9·34	2·95
,, Ortinola estate	3·04	0·52	10·19	3·61
Caura—Wardour estate	1·17	0·37	5·85	2·25
West Central District.				
Caroni—Frederick estate	1·79	0·40	5·53	2·97
Chaguanas—Constabulary Station	0·74	0·35	5·11	3·04
,, Woodford Lodge estate	0·82	0·41	5·20	3·20
Carapichaima—Waterloo estate	0·76	0·15	5·89	3·54
,, Friendship Hall estate	0·70	0·45	4·50	5·00
Couva—Exchange estate	0·69	0·63	4·15	5·62
,, Brechin Castle estate	0·71	0·73	6·04	4·89
,, Perseverance ,,	0·67	0·43	4·17	4·29
,, Camden ,,	0·74	1·01	5·91	4·48
,, Milton ,,	1·10	0·88	7·19	6·09
,, Spring ,,	1·29	0·78	8·14	5·54
,, Constabulary Station	0·69	1·14	5·61	5·40
,, Esperanza estate, Savonetta	0·65	0·33	6·63	5·66
Montserrat District.				
Montserrat Constabulary Station	0·76	0·30	6·60	5·66
Brasso—La Vega estate	1·41	0·34	10·59	6·74
Arima District.				
Arima—Warden's Office	0·66	1·45	4·85	2·12
,, Torrecilla estate	1·34	0·24	6·77	3·78
,, Verdant Vale estate	2·23	0·27	9·03	4·98
San Rafael—Coustabulary Station	2·58	0·34	11·47	5·81
Guanapo—Talparo estate	2·43	0·59	9·99	6·28
,, San José Estate	1·98	0·97	11·57	8·60
Tamana—Sta. Marta estate	2·95	0·85	14·07	9·29
,, La Corona estate	3·44	...	14·31	...
San Fernando & Princes Town District.				
Claxton's Bay—Forres Park estate	0·52	0·33	7·15	4·84
Pointe-à-Pierre—Bonne Aventure est.	0·56	0·72	6·46	6·63
,, Concord estate	0·61	0·78	7·27	7·79
,, Plein Palais estate	0·55	1·20	6·35	5·17
Naparima—Picton estate	1·33	1·56	7·08	7·57
,, Usine St. Madeleine	0·85	1·85	7·80	6·61
,, La Fortunée estate	0·61	1·22	7·30	5·37

RAINFALL RETURN FOR FEBRUARY, 1916.—CONTD.

Stations.	February, 1916.	February, 1915.	Jan. & Feb. 1916.	Jan. & Feb. 1915.
San Fernando and Princes Town District.—(Cont'd.)	Ins.	Ins.	Ins.	Ins.
Naparima—Lewisville	1·03	1·86	9·11	8·20
,, Tarouba estate	Nil	1·27	4·52	9·66
,, Union Hall ,,	0·92	0·68	7·55	4·20
,, Palmiste ,,	1·63	1·01	7·47	5·59
,, Hermitage ,,	1·15	0·80	6·34	5·61
Princes Town—Craignish ,,	1·04	1·21	8·05	7·04
,, Cedar Hill estate	0·70	2·18	7·60	6·78
,, Williamsville estate	1·42	1·05	12·29	7·34
,, Esmeralda estate	0·87	0·72	9·33	7·29
,, New Grant estate	1·18	1·28	7·91	9·77
,, Constabulary Station	0·87	2·15	7·05	6·04
,, Hindustan estate	1·80	0·73	8·85	7·08
,, La Retraite estate	1·62	1·56	14·26	10·68
,, Malgretoute estate	1·08	1·77	9·99	6·96
Savana Grande—Friendship & Ben Lomond estates	0·20	1·10	8·84	6·87
Poole—El Rosario estate	1·83	1·40	13·77	9·35
Naparima, Petit Morne estate	0·33	...	...	...
South-west District.				
Oropuche—Constabulary Station	1·22	1·17	6·77	8·63
,, Pluck estate	1·64	1·19	8·83	7·27
Siparia—Constabulary Station	2·13	3·45	7·01	9·87
,, Alta Gracia estate	2·35	2·16	9·55	6·98
Guapo—Adventure estate	2·52	1·30	7·74	4·94
Point Fortin—Constabulary Station	4·50	1·74	10·46	6·51
Erin—La Ressource estate	2·24	3·10	4·22	7·82
,, Industry estate	1·96	1·39	7·74	5·40
Cedros—La Retraite estate	5·49	2·27	12·82	6·26
,, Constabulary Station	2·26	2·00	8·85	5·05
,, Beaulieu estate	3·66	0·06	10·36	...
,, Perseverance estate	2·64	1·91	9·54	5·18
,, St. Marie estate	2·41	1·90	9·41	5·18
Icacos—Constance estate	1·53	1·75	8·14	4·50
Irois—Government School	4·57	2·70	11·35	8·48
South Coast.				
Moruga—Constabulary Station	1·79	0·94	6·48	4·96
East Coast.				
Matura—La Juanita estate	3·20	0·53	10·44	4·06
Manzanilla—Constabulary Station	2·20	1·18	12·73	7·33
Sangre Grande—San Hilario estate	3·13	...	10·11	...
,, New Lands estate	1·91	0·71	10·94	9·53
,, Evasdale estate	3·95	1·32	13·91	7·59
,, Grosvenor estate	3·35	1·17	13·78	7·15
Mayaro—Constabulary Station	1·67	0·30	10·75	6·51
North Coast.				
Blanchisseuse—Constabulary Station	2·62	0·22	11·74	4·72
Grande Rivière—Mon Plaisir estate	4·55	2·35	14·09	5·45
Toco—Aragua House	4·11	1·26	10·37	6·04
,, Constabulary Station	2·98	0·30	8·85	3·57
Point Galera—Light House	3·53	0·16	5·51	1·81
Tobago.				
Tobago—Hermitage estate	3·25	1·07	12·16	4·87
,, Riversdale ,,	1·95	1·47	6·00	5·13
,, King's Bay ,,	3·00	0·76	11·55	5·65
,, Roxburgh	4·38	1·08	15·71	7·81
,, Lure estate	4·12	1·84	14·33	8·09
,, Botanic Station	1·93	1·10	9·41	5·12
,, Government Farm	1·45	0·19	6·08	2·79
,, Lowlands estate	1·24	0·48	7·18	4·17
,, Friendship estate	1·44	0·47	7·07	4·27
,, Bon Accord estate	1·35	0·57	7·54	3·52

NOTES.

Mr. C. B. Williams, M.A. (Camb.), F.E.S. has been appointed to conduct investigations for two years with a view of securing the introduction of parasites of the froghopper (*Tomaspis varia*) the sugar cane pest. Mr. Williams was previously in the Colony on a visit whilst Research Scholar of the John Innes Institute, England.

Mr. Williams will work under the direction of the Froghopper Committee, composed of His Excellency the Governor, the Director of Agriculture and the Hon. W. G. Kay representing the sugar proprietors who are contributing half the expenses.

Mr. R. O. Williams the Curator of the Botanical Department, arrived on February 27.

Colonel Theodore Roosevelt, was recently a visitor to the Colony. He was entertained at dinner by the Chamber of Commerce and Agricultural Society. During his stay he visited several places of natural history interest—including the cave in the heights of Oropuche inhabited by the Guacharo, Oil Bird or Diablotin (*Steatornis caripensis*.)

The Colony has recently been the scene of scientific investigations by a party of the Marine Biological Laboratory of the Carnegie Institute, consisting of Dr. A. G. Mayer, the Director; Dr. H. L. Clark, Curator of Echinoderms in the Museum of Comparative Zoology, Cambridge, Mass.; and Dr. T. Mortensen, Assistant Director of the Zoological Museum, Copenhagen, Denmark. Several weeks were spent in Tobago, investigating, with very interesting results, the echinoderms of the coral reefs, jelly fish and other groups. Dr. Clark has kindly presented a representative collection of the echinoderms to the Museum of the Royal Victoria Institute, Port-of-Spain.

Mr. W. Buthn has been appointed from May 1, Laboratory and Field Assistant to the Board of Agriculture.

His Excellency the President has appointed a committee of the Board of Agriculture to collect information regarding the present position of the rubber industry of the Colony, and to advise as to its future development. The committee consists of the Hon. Sir Norman Lamont, Bart., (Chairman), Hon. R. S. Aucher Warner, K.C., (Solicitor-General), Mr. W. G. Freeman, (Assistant Director of Agriculture) and Mr. C. S. Rogers (Forest Officer).

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BULLETIN
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Trinidad and Tobago.

PART 4.] 1916. [VOL. XV.

CACAO.

REPORT ON EXPERIMENTS FOR THE YEAR SEPTEMBER 1, 1914, TO AUGUST 31, 1915.

BY JOSEPH DE VERTEUIL, F.C.S.
Superintendent of Field Experiments.

River Estate.

MANURIAL, SHADE, CHUPON AND NATURAL YIELD PLOTS.

EXPLANATORY NOTES.—All the plots have been treated in the same manner as in previous years. The manures were applied broadcast to within three feet of the trunk of each tree, about two feet from the edge of the drains and the soil forked to a depth of about six inches. The control plots were also forked but no manures added. On plots which received basic slag, sulphate of potash and sulphate of ammonia, the sulphates of potash and ammonia were applied two months after the slag. There has been a further decrease in the cost of mulching of approximately $3 (12s. 6d.) per acre but it is still a very expensive operation.

Throughout this report the age of the trees given is the approximate age during the first year of the experiments. In calculating the results recorded in the various tables it has been assumed that twelve pods produce a pound of dry cacao, and the value of the marketable produce has been continued at eleven cents (5½d.) per pound.

The corresponding number of bags per 1,000 trees can be found by dividing the number of pods per tree by two.

RAINFALL.

The rainfall for the twelve months from May 1, 1914 to April 31, 1915 was 60·44 inches, a further decrease of 2·42 inches on the previous year. The season under review has not been as favourable as that of the previous year, as can be seen at a glance at diagram VI (*Natural yield* plots). Nevertheless, several of the manured plots have given an increase in yield compared with the crop of 1913-14 *vide* Tables I, V and VI.

The monthly rainfall registered at River Estate during the past five years is given below.

MONTH.	1910-11.	No. of days rain fell.	1911-12.	No. of days rain fell.	1912-13.	No. of days rain fell.	1913-14.	No. of days rain fell.	1914-15.	No. of days rain fell.
May ...	5·38	16	0·55	6	4·09	17	2·32	9	3·85	13
June ...	8·96	21	10·93	27	7·71	24	6·05	19	5·88	19
July ...	8·29	16	8·17	22	12·96	24	5·91	18	8·84	22
August ...	10·72	23	15·35	26	7·79	23	16·10	24	4·74	20
September ...	6·90	20	7·09	20	9·16	21	11·14	22	9·21	20
October ...	6·18	16	4·68	20	4·86	12	4·76	19	9·83	20
November ..	7·39	20	4·32	15	5·45	18	8·20	23	6·03	19
December ...	2·89	12	2·97	13	7·35	22	4·00	14	4·80	22
January ...	2·00	12	0·84	7	3·79	21	0·58	6	1·84	9
February ...	2·98	9	0·53	5	1·64	13	0·96	14	1·04	8
March ...	1·92	6	0·99	8	1·43	15	1·18	10	0·04	2
April ...	1·08	6	0·30	2	0·43	7	1·66	7	4·34	15
Total ...	64·69	177	56·72	171	66·66	217	62·86	185	60·44	189

The yield of each plot for this and previous years is shown graphically for each set of experiments, so that the increase or decrease for the various plots from year to year can be seen at a glance.

In each set of experiments where the yield of individual trees has been kept, the results obtained have also been calculated and tabulated in percentages of trees giving less than 13 pods per tree annually, from 13 to 25 pods per tree, etc., as shewn in Tables II, IV, X, XIII, etc.

MANURIAL EXPERIMENTS.

A.—Field No. 1.—The artificial manures and mulch were applied during the middle of February, but the pen manure to plots E, F, P and Q was only applied on March 26, and the sheep manure to plot D on April 13, 1914. The results for the year are given in Table I, and the average number of pods picked per tree for previous years is also included for comparison. There are 50 trees, more or less, in each plot.

The cacao reaped from all the plots in Field No. 1 and from the plots on the Brooklyn Estate, during the year, have been dried and weighed separately. The results for this and previous years are recorded below.

Estate.	Crop, September 1, to August 31.	Total number of pods picked.	Lb. dry Cacao.	Pods per lb. dry Cacao.
River	1911-12 ..	35,596	2,779	12·81
	1912-13 ...	46,137	3,839	12·02
	1913-14 ...	56,294	4,710	11·95
	1914-15 ...	55,121	4,597	11·99
Average for 4 years	...	**48,287**	**3,981**	**12·13**
Brooklyn ...	1911-12 ...	68,261	5,520	12·37
	1912-13 ...	80,098	7,363	10·88
	1913-14 ...	92,141	8,185	11·26
	1914-15 ...	64,412	5,862	10·99
Average for 4 years	...	**76,228**	**6,732**	**11·32**

During the period under review there has been a further increase in yield on the previous year from plots H, I, J, L, Q, S, T, U and V. I will be observed that U is a control or *no manure* plot. 113 pounds less of dry cacao have been reaped from all of the plots than during the previous twelve months, but 1,383 pounds more than in 1910-11, calculated on a basis of 12 pods to a pound of dry cacao. Plots H, I, J, V and W have given a larger increase than any of the control plots and C, L, Q, S and T have given better results than the average of the Control Plots which shows a decrease of 0·87 pods per tree.

Compared with 1910-11 plots C, D, F, H, I, J, Q and S have given a larger increase than any of the control plots and B, E, O and P, show a larger increase than the average for the control plots.

TABLE I.– MANURIAL EXPERIMENTS—FIELD NO. 1.

Trees about 11 years old in 1910.

Plot.	Manures applied per plot *each year from 1910.*	Crop, September 1, to August 31.	Average Number of Pods picked per tree.	Per acre of 300 trees. No. of pods picked.	Lb. dry cacao.	Value of dry cacao at 11 cents per lb.	Cost of manuring.	Col. A less Col. B.
			*			(A) $ c.	(B) $ c.	$ c.
A.	**Control—No manure**	**1910-11...**	**18·3**					
		1911-12...	**20·51**					
		1912-13..	**22·00**					
		1913-14..	**34·27**					
		1914-15...	**31·67**	**9,501**	**792**	**87.12**	..	**87.12**
B.	280 lb. Sheep manure 100 ,, Bone meal 25 ,, Sulphate of potash	1910-11 ...	19·4					
		1911-12 ...	17·02					
		1912-13 ...	29·78					
		1913-14 ...	36·06					
		1914-15 ...	35·14	10,542	878	96.58	22.84	73.74
C.	280 lb. Sheep manure 13 ,, Sulph. of ammonia 13 ,, Sulphate of potash	1910-11 ..	21·0					
		1911-12 ...	20·31					
		1912-13 ...	36·88					
		1913-14 ...	43·52					
		1914-15 ...	42·73	12,819	1,068	117.48	13.04	104.44
D.	560 lb. Sheep manure	1910-11 ...	26·6					
		1911-12 .	30·27					
		1912-13 ...	47·15					
		1913-14 ...	50·21					
		1914-15 ...	45·36	13,608	1,134	124.74	16.67	108.07
E.	7,200 lb. Pen manure	1910-11 ...	38·0					
		1911-12 ..	35·60					
		1912-13 ...	49·40					
		1913-14 ...	57·61					
		1914-15 ...	54·71	16,413	1,368	150.48	24.81	125.67
F.	3,600 lb. Pen manure 100 ,, Basic slag 13 ,, Sulphate of potash	1910-11 ...	33·9					
		1911-12 ...	34·24					
		1912-13 ...	41·28					
		1913-14 ...	54·78					
		1914-15 ...	53·82	16,146	1,345	147.95	19.85	128.10
G.	**Control—No manure**	**1910-11...**	**29·8**					
		1911-12 ..	**32·56**					
		1912-13...	**39·04**					
		1913-14...	**50·28**					
		1914-15..	**46·85**	**14,055**	**1,171**	**128·81**	..	**128·81**
H.	187 lb. Bird manure	1910-11 ...	32·1					
		1911-12 ...	25·29					
		1912-13 ...	33·02					
		1913-14 ...	37·74					
		1914-15 ...	52·15	15,645	1,304	143.44	10.56	132.88

*Dividing the figures in this column by 2 gives approximately the number of bags (165 lb.) dry cacao per 1,000 trees.

TABLE I.—*Contd.*—MANURIAL EXPERIMENTS—FIELD NO. 1.

Plot.	Manures applied per plot *each year from 1910.*	Crop, September 1, to August 31.	Average Number of pods picked per tree.	Per acre of 300 trees.				
				No. of pods picked.	Lb. dry cacao.	Value of dry cacao at 11 cents per lb.	Cost of manuring.	Col. A less Col. B.
			*			(A) $ c.	(B) $ c.	$ c.
I.	94 lb. Bird manure 25 ,, Sulph. of ammonia 50 ,, Sulphate of potash	1910-11 ...	38·4					
		1911-12 ...	31·58					
		1912-13 ...	48·19					
		1913-14 ...	55·33					
		1914-15 ...	66·19	19,857	1,655	182.05	18.46	163.59
J.	94 lb. Bird manure 13 ,, Sulph. of ammonia 25 ,, Sulphate of potash	1910-11 ...	30·9					
		1911-12 ...	28·30					
		1912-13 ...	42·00					
		1913-14 ...	48·02					
		1914-15 ...	52·15	15,645	1,304	143.44	12.00	131.44
K.	94 lb. Bird manure 100 ,, Basic slag 25 ,, Sulphate of potash	1910-11 ...	27·8					
		1911-12 ...	30·59					
		1912-13 ...	37·90					
		1913-14 ..	41·21					
		1914-15 ...	39·92	11,976	998	109.78	15.00	94.78
L.	187 lb. Lime ...	1910-11 ...	14·1					
		1911-12 ...	14·67					
		1912-13 ...	18·69					
		1913-14 ...	19·90					
		1914-15 ...	22·52	6,756	563	61.93	3.00	58.93
M.	5,000 lb. Mulch 100 ,, Basic slag 25 ,, Sulph. of potash	1910-11 ...	29·4					
		1911-12 ...	21·74					
		1912-13 ...	26·40					
		1913-14 ...	44·04					
		1914-15 ...	40·18	12,054	1,004	110.44	33.81	76.63
N.	5,000 lb. Mulch 50 ,, Basic slag 13 ,, Sulph. ammonia 13 ,, Sulph. of potash	1910-11 ..	19·5					
		1911-12 ...	19·00					
		1912-13 ...	22·31					
		1913-14 ...	37·17					
		1914-15 ...	32·31	9,693	808	88.88	29.13	59.75
O.	10,000 lb. Mulch	1910-11 ...	22.0					
		1911-12 ...	21·00					
		1912-13 ...	30·94					
		1913-14 ...	39·06					
		1914-15 ...	38·10	11,430	952	104.72	53·08	51·64
P.	3,600 lb. Pen Manure 100 ,, Bone meal 13 ,, Sulph. ammonia 13 ,, Sulph. of potash	1910-11 . .	34·8					
		1911-12 ...	35·40					
		1912-13 . .	42·83					
		1913-14 ...	54·02					
		1914-15 .	49·45	14,835	1,236	135.96	27.06	108.90

TABLE I. (*Contd.*)—MANURIAL EXPERIMENT.—FIELD NO. 1.

Plot.	Manures applied per plot. *each year from 1910.*	Crop, Septemler 1, to August 31.	Average number of pods picked per tree.	Per acre of 300 trees. No. of pods picked.	Per acre of 300 trees. Lb. dry Cacao.	Per acre of 300 trees. Value of dry Cacao at 11 cents per lb.	Per acre of 300 trees. Cost of manuring.	Per acre of 300 trees. Col. A less Col. B.
			*			(A) $ c.	(A) $ c.	$ c.
Q.	3,600 lb. Pen manure 13 ,, Sulph. ammonia 25 ,, Sulph. of potash	1910-11 ...	43·4					
		1911-12 ..	45·61					
		1912-13 ..	55·00					
		1913-14 ...	67·65					
		1914-15 ...	70·00	21,000	1,750	192.50	19.09	173.41
R.	25 lb. Sulph. ammonia 25 ,, Sulph. of potash	1910-11 ...	39·5					
		1911-12 ...	35·55					
		1912-13 ...	46·26					
		1913-14 ...	57·51					
		1914-15 ...	50·72	15,216	1,268	139.48	9·17	130.31
S.	200 lb. Bone meal 25 ,, Sulph. ammonia 25 ,, Sulph. of potash	1910-11 ...	26·2					
		1911-12 ...	21·12					
		1912-13 ...	37·73					
		1913-14 ...	47·79					
		1914-15 ...	47·91	14,373	1,198	131.78	30.00	101.78
T.	100 lb. Basic slag 25 ,, Sulph. ammonia 25 ,, Sulph. of potash	1910-11 ...	28·9					
		1911-12 ...	33·07					
		1912 13 ...	34·08					
		1913-14 ...	41·21					
		1914-15 ...	42·65	12,795	1.066	117.26	14.65	102.61
U.	**Control—No manure**	**1910-11...**	**32·1**					
		1911-12...	**30·92**					
		1912-13...	**35·67**					
		1913-14..	**41·51**					
		1914-15...	**44·92**	**13,476**	**1,123**	**123.53**	...	**123·53**
V.	187 lb. Bird manure	1910-11 ...	38·8					
		1911-12 ..	40·33					
		1912-13 ...	39·60					
		1913-14 ...	44·63					
		1914-15 ...	50·11	15,033	1,253	137.88	10.56	127.27
W.	94 lb. Lime	1910-11 ...	39·1					
		1911-12 ...	38·16					
		1912-13 ...	38·27					
		1913-14 ...	32·45					
		1914-15 ...	37·12	11,136	928	102.08	2.36	99.72

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*Dividing the figures in this column by 2 gives approximately the number of bags (165 lb.) dry cacao per 1,000 trees.

Table II.—Yield of Individual Trees in Field No. 1.

Trees about 11 years old in 1910.

Plot.	Number of trees.	Crop, Sept. 1, to August 31.	Per cent. Trees Bearing the following Number of Pods in each Year.						Average number of pods picked per tree.
			0-12.	13-25.	26-50.	51-75.	76-100.	Over 100.	
A. Control	49	1911-12	49·0	20·4	20·4	6·1	4·1	...	20·51
	45	1912-13	42·2	24·4	26·7	4·5	...	2·2	22·00
	44	1913-14	22·7	25·0	36·4	2·3	9·1	4·5	34·27
	43	1914-15	16·3	37·2	30·2	9·3	4·6	2·4	31·67
Av'ge. for 4 years			32·6	26·8	28·4	5·5	4·4	2·3	
B.	51	1911-12	49·0	21·6	27·4	2·0	...	...	17·02
	51	1912-13	25·5	21·6	37·2	9·8	5·9	...	29·78
	51	1913-14	21·6	19·6	29·4	23·5	2·0	3·9	36·06
	51	1914-15	17·7	23·5	35·3	15·7	7·8	...	35·14
Av'ge. for 4 years			28·5	21·6	32·3	12·7	3·9	1·0	
C.	49	1911-12	38·8	26·5	28·6	6·1	...	...	20·31
	49	1912-13	14·3	12·3	46·9	20·4	4·1	2·0	36·88
	48	1913-14	6·3	18·7	41·7	20·8	8·3	4·2	43·52
	48	1914-15	12·5	20·8	27·1	29·2	8·3	2·1	42·73
Av'ge. for 4 years			18·0	19·6	36·1	19·1	5·2	2·0	
D.	52	1911-12	13·4	30·8	40·4	15·4	...	...	30·27
	52	1912-13	9·6	9·6	38·5	30·8	7·7	3·8	47·15
	52	1913-14	5·8	11·5	42·3	26·9	7·7	5·8	50·21
	52	1914-15	5·8	17·3	48·1	19·2	1·9	7·7	45·36
Av'ge. for 4 years			8·7	17·3	42·3	23·1	4·3	4·3	
E.	50	1911-12	14·0	20·0	38·0	22·0	6·0	...	35·60
	50	1912-13	8·0	14·0	36·0	22·0	14·0	6·0	49·40
	49	1913-14	6·1	14·3	30·6	16·4	16·3	16·3	57·61
	49	1914-15	8·2	14·3	32·6	18·4	16·3	10·2	54·71
Av'ge. for 4 years			9·1	15·7	34·3	19·7	13·1	8·1	
F.	49	1911-12	32·7	20·4	20·4	12·2	10·2	4·1	34·24
	49	1912-13	28·6	12·2	22·5	24·5	6·1	6·1	41·28
	45	1913-14	17·8	11·1	31·1	8·9	11·1	20·0	54·78
	44	1914-15	11·4	15·9	29·5	18·2	9·1	15·9	53·82
Av'ge. for 4 years			22·6	14·9	25·9	16·0	9·1	11·5	
G. Control	50	1911-12	20·0	28·0	34·0	12·0	4·0	2·0	32·56
	50	1912-13	20·0	16·0	24·0	34·0	2·0	4·0	39·04
	49	1913-14	10·2	14·3	30·6	24·5	10·2	10·2	50·28
	46	1914-15	6·5	19·6	43·5	17·4	2·1	10·9	46·85
Av'ge. for 4 years			14·2	19·5	33·0	22·0	4·6	6·7	
H.	48	1911-12	29·1	31·3	20·8	18·8	..	...	25·29
	47	1912-13	29·8	14·9	40·4	6·4	4·3	4·2	33·02
	46	1913-14	21·7	17·4	41·3	8·7	4·4	6·5	37·74
	45	1914-15	17·8	15·5	17·8	26·7	15·5	6·7	52·15
Av'ge. for 4 years			24·6	19·8	30·1	15·2	6·0	4·3	

TABLE II. (*Contd.*)—YIELD OF INDIVIDUAL TREES IN FIELD NO. 1.

Trees about 11 years old in 1910.

Plot.	Number of trees.	Crop, Sept. 1, to August 31.	PER CENT. TREES BEARING THE FOLLOWING NUMBER OF PODS IN EACH YEAR.						Average number of pods picked per tree.
			0-12.	13-25.	26-50.	51-75.	76-100.	Over 100.	
I.	48	1911-12	22·9	31·3	25·0	14·6	6·2	...	31·58
	48	1912-13	18·8	12·5	33·3	18·7	4·2	12·5	48·19
	48	1913-14	10·4	8·4	37·5	20·8	8·3	14·6	55·33
	48	1914-15	4·2	20·8	31·2	14·6	12·5	16·7	66·19
Av'ge. for 4 years			**14·1**	**18·2**	**31·8**	**17·2**	**7·8**	**10·9**	
J.	50	1911-12	32·0	20·0	32·0	12·0	...	4·0	28·30
	49	1912-13	22·4	14·3	28·6	20·4	6·1	8·2	42·00
	48	1913-14	16·7	14·6	29·1	18·8	14·6	6·2	48·02
	45	1914-15	15·6	15·5	26·7	22·2	8·9	11·1	52·15
Av'ge. for 4 years			**21·7**	**16·1**	**29·1**	**18·3**	**7·4**	**7·4**	
K.	51	1911-12	25·5	21·6	33·3	13·7	3·9	2·0	30·59
	51	1912-13	15·7	25·5	31·4	17·6	5·9	3·9	37·90
	51	1913-14	19·6	17·6	27·5	21·6	9·8	3·9	41·21
	51	1914-15	7·8	23·6	35·3	23·5	7·8	2·0	39·92
Av'ge. for 4 years			**17·2**	**22·1**	**31·9**	**19·1**	**6·8**	**2·9**	
L.	49	1911-12	57·1	18·4	20·5	2·0	2·0	...	14·67
	49	1912-13	42·8	28·6	18·4	10·2	...	...	18·69
	49	1913-14	38·8	24·5	28·6	8·1	...	...	19·90
	48	1914-15	31·3	31·2	33·3	2·1	2·1	...	22·52
Av'ge. for 4 years			**42·5**	**25·7**	**25·2**	**5·6**	**1·0**	...	
M.	50	1911-12	38·0	30·0	22·0	8·0	2·0	...	21·74
	50	1912-13	24·0	26·0	46·0	4·0	...	...	26·40
	49	1913-14	16·3	12·3	30·6	26·5	10·2	4·1	44·04
	49	1914-15	16·3	20·4	30·6	22·5	6·1	4·1	40·18
Av'ge. for 4 years			**23·7**	**22·2**	**32·3**	**15·2**	**4·6**	**2·0**	
N.	49	1911-12	44·9	26·5	22·5	4·1	2·0	...	19·00
	49	1912-13	42·9	20·4	26·5	6·1	4·1	...	22·31
	48	1913-14	29·1	12·5	31·3	12·5	10·4	4·2	37·17
	48	1914-15	25·0	22·9	31·2	14·6	2·1	4·2	32·31
Av'ge. for 4 years			**35·5**	**20·6**	**27·9**	**9·3**	**4·6**	**2·1**	
O.	51	1911-12	29·4	43·2	19·6	7·8	...	...	21·00
	50	1912-13	14·0	26·0	46·0	10·0	4·0	...	30·94
	50	1913-14	12·0	26·0	34·0	14·0	12·0	2·0	39·06
	50	1914-15	14·0	24·0	32·0	22·0	6·0	2·0	38·10
Av'ge. for 4 years			**17·4**	**29·8**	**32·9**	**13·4**	**5·5**	**1·0**	
P.	52	1911-12	21·2	28·8	25·0	9·6	9·6	5·8	35·40
	52	1912-13	13·5	21·1	30·8	23·1	3·8	7·7	42·83
	52	1913-14	5·8	13·5	36·5	23·1	9·6	11·5	54·02
	51	1914-15	5·8	15·7	41·2	15·7	15·7	5·9	49·45
Av'ge. for 4 years			**11·6**	**19·8**	**33·4**	**17·9**	**9·6**	**7·7**	

TABLE II (*Contd.*)—YIELD OF INDIVIDUAL TREES IN FIELD No. 1.

Trees about 11 years old in 1910.

Plot.	Number of trees.	Crop, Sept., 1 to August 31.	PER CENT. TREES BEARING THE FOLLOWING NUMBER OF PODS IN EACH YEAR.						Average number of pods picked per tree.
			0-12.	13-25.	26-50.	51-75.	76-100.	Over 100.	
Q.	49	1911-12	12·3	20·4	30·6	20·4	14·3	2·0	45·61
	48	1912-13	6·3	6·2	37·5	29·2	4·2	16·6	55·00
	46	1913-14	4·3	4·3	26·1	26·1	19·6	19·6	67·65
	42	1914-15	...	11·9	23·8	21·5	19·0	23·8	70·00
Av'ge. for 4 years			**5·7**	**10·7**	**29·5**	**24·3**	**14·3**	**15·5**	
R.	51	1911-12	27·5	29·4	17·6	11·8	5·9	7·8	35·55
	50	1912-13	26·0	16·0	24·0	16·0	4·0	14·0	46·26
	49	1913-14	20·4	10·2	28·6	18·4	6·1	16·3	57·51
	47	1914-15	19·1	19·2	25·5	12·8	8·5	14·9	50·72
Av'ge. for 4 years			**23·3**	**18·7**	**23·9**	**14·8**	**6·1**	**13·2**	
S.	49	1911-12	44·9	26·5	14·3	12·2	2·1	...	21·12
	49	1912-13	30·6	14·3	16·3	28·6	6·1	4·1	37·73
	47	1913-14	21·3	23·4	19·1	14·9	6·4	14·9	47·79
	47	1914-15	23·4	10·7	31·9	8·5	10·6	14·9	47·91
Av'ge. for 4 years			**30·1**	**18·7**	**20·4**	**16·0**	**6·3**	**8·5**	
T.	52	1911-12	36·5	23·1	30·8	7·7	1·9	...	23·08
	52	1912-13	26·9	15·4	30·8	21·2	3·8	1·9	34·08
	52	1913-14	17·3	17·3	36·5	13·5	11·5	3·9	41·21
	52	1914-15	15·4	15·4	40·4	15·4	7·7	5·7	42·65
Av'ge. for 4 years			**24·0**	**17·8**	**34·6**	**14·5**	**6·2**	**2·9**	
U. Control	**51**	**1911-12**	**29·4**	**21·6**	**25·5**	**17·6**	**3·9**	**2·0**	**30·92**
	51	**1912-13**	**21·6**	**27·5**	**19·6**	**23·5**	**3·9**	**3·9**	**35·67**
	51	**1913-14**	**13·7**	**11·8**	**45·1**	**17·7**	**7·8**	**3·9**	**41·51**
	51	**1914-15**	**11·7**	**19·6**	**41·2**	**11·8**	**3·9**	**11·8**	**44·92**
Av'ge. for 4 years			**19·1**	**20·1**	**32·9**	**17·6**	**4·9**	**5·4**	
V.	52	1911-12	7·7	19·2	36·5	30·8	5·8	...	40·33
	52	1912-13	11·5	21·2	42·3	9·6	15·4	...	39·60
	52	1913-14	9·6	19·2	30·8	34·6	1·9	3·9	44·63
	52	1914-15	7·7	11·5	34·6	26·9	13·5	5·8	50·11
Av'ge. for 4 years			**9·1**	**17·8**	**36·1**	**25·5**	**9·1**	**2·4**	
W.	51	1911-12	17·7	23·5	31·4	15·7	7·8	3·9	38·16
	51	1912-13	23·5	21·6	27·5	9·8	13·7	3·9	38·27
	51	1913-14	25·5	27·4	25·5	13·7	5·9	2·0	32·45
	51	1914-15	21·6	19·6	29·4	17·6	5·9	5·9	37·12
Av'ge. for 4 years			**22·1**	**23·0**	**28·5**	**14·2**	**8·3**	**3·9**	

There are also three other plots in Field No. 1, viz; X, Y and Z from which the yield has been recorded during the past five years and the number of pods from the individual trees counted for the past four years. The yield from these plots are recorded in Tables III and IV. These figures may be considered as the *natural yield* of the plots for although plot X was treated with 2 lb. nitrate of lime and Y and Z with 3 and 2 lb. per tree respectively in July 1910 with a mixed manure imported by Mr. D. Majani, there has been no increase in the yield until the favourable season of 1913–14 (*vide* Table III), and the manures may be considered as having produced no effect on the crops.

On May 12, 1915 plots X and Z were treated with the following manures to test the relative value of dried blood and sulphate of ammonia :—Plot X—1 lb. dried blood, 2 lb. bone meal and ½ lb. sulphate of potash per tree, and plot Z—½ lb. sulphate of ammonia, 2 lb. bone meal and ½ lb. sulphate of potash per tree. These manures will be applied yearly as is done in the case of the other manurial experiments and plot Y will be kept as a control.

TABLE III.—NATURAL YIELD OF PLOTS X, Y AND Z.—FIELD No. 1.

Trees about 10 years old in 1910.

Plot.	AVERAGE NUMBER OF PODS PICKED PER TREE SEP. 1 TO AUG. 31.					
	1910-11.	1911-12.	1912-13.	1913-14.	1914-15.	Average for 5 years 1910-15.
X ...	16·61	9·13	14·35	26·02	19·08	**16·93**
Y ...	18·59	17·74	19·89	28·50	26·54	**22·10**
Z ...	29·21	17·98	19·56	33·88	34·26	**26·92**

TABLE IV.—NATURAL YIELD OF INDIVIDUAL TREES IN PLOTS X, Y AND Z.—FIELD No. 1.

Trees about 10 years old in 1910.

Plot.	Number of trees.	Crop, Sep. 1, to August 31.	PER CENT. TREES BEARING THE FOLLOWING NUMBER OF PODS IN EACH YEAR.						Average number of pods picked per tree.
			0-12.	13-25.	26-50.	51-75.	76-100.	Over 100.	
X ...	52	1911–12	73·1	21·2	3·8	1·9	...	..	9·13
	49	1912–13	59·2	18·4	20·4	2·0	...	...	14·35
	49	1913–14	38·8	28·6	12·2	12·2	4·1	4·1	26·02
	48	1914–15	54·2	18·7	16·7	6·2	4·2	...	19·08
Average for 4 years...			**56·3**	**21·7**	**13·3**	**5·6**	**2·1**	**1·0**	**16·42**
Y ...	100	1911–12	48·0	22·0	27·0	2·0	1·0	...	17·74
	94	1912–13	43·6	26·6	20·2	9·6	..	..	19·89
	92	1913–14	27·2	30·4	30·4	7·6	1·1	3·3	28·50
	91	1914–15	25·3	29·6	31·9	9·9	3·3	...	26·54
Average for 4 years...			**36·0**	**27·2**	**27·4**	**7·3**	**1·3**	**0·8**	**21·05**
Z ..	52	1911–12	55·8	19·2	17·3	3·9	3·8	...	17·98
	52	1912–13	42·3	34·6	13·5	5·8	3·8	...	19·56
	50	1913–14	18·0	26·0	32·0	18·0	2·0	4·0	33·88
	50	1914–15	28·0	16·0	32·0	16·0	2·0	6·0	34·26
Average for 4 years...			**36·0**	**24·0**	**23·7**	**10·9**	**2·9**	**2·5**	**25·14**

B.—FIELD No. 6.—The treatment given to each plot, and the results obtained for this and previous years, are recorded in Table V. Plot 4 was mulched during the second week of February; pen manure was applied to plot 7 during the last fortnight of March; plots 1 and 3 were manured on April 28; all the other plots on March 4, 1914. No forking was done except on plot 7 (pen manure).

Plots 5 and 6 have given an increase in yield on the previous year and plot 3 shows a smaller decrease than that from the control plot. Compared with 1910–11, all the plots, except plot 2 have given an increase whereas the control or *no manure* plot 9 shows a decrease of 0·61 pod per tree.

The yield for the whole field this year is 11·89 bags per 1,000 trees compared with 12·82 bags last year and 5·64 bags for the year preceding the application of manures.

TABLE V—MANURIAL EXPERIMENTS.—FIELD No. 6.

Trees 25 to 30 years old in 1910.

Plot.	Number of bearing trees.	Manures applied per plot *each year from 1910.*	Crop, September 1, to August 31.	Average number of pods picked per tree.	Per acre of 220 trees.				
					Number of pods picked.	Lb. dry Cacao.	Value of dry cacao at 11 cents per lb.	Cost of manuring.	Column A less Column B.
							(A)	(B)	
				*			$ c.	$ c.	$ c.
1	925	4 tons Sheep manure	1910–11	16·8					
			1911–12	10·70					
			1912–13	13·84					
			1913–14	21·71					
			1914–15	16·95	3,729	311	34.21	9.66	24.55
2	547	1 ton Bird manure	1910–11	31·1					
			1911–12	30·99					
			1912–13	24·82					
			1913–14	27·28					
			1914–15	23·36	5,139	428	47.08	9.27	37.81
3	520	1 ton Sheep manure 1 ton Bird manure	1910–11	28·8					
			1911-12	32·11					
			1912–13	23·77					
			1913–14	29·95					
			1914–15	29·39	6,466	539	59.29	13.65	45.64
4	185	18 tons Mulch	1910–11	30·1					
			1911–12	31·85					
			1912–13	27·44					
			1913–14	37·99					
			1914–15	36·42	8,012	668	73.48	22.10	51.38

* *Vide* Table I (foot note.)

TABLE V (*Contd.*)—MANURIAL EXPERIMENTS.—FIELD NO. 6.

Trees 25 to 30 years old in 1910.

Plot.	Number of bearing trees.	Manures applied per plot *each year from 1910.*	Crop, September 1, to August 31.	Average number of pods picked per tree.	Per acre of 220 trees.				
					Number of pods picked.	Lb. dry cacao.	Value of dry cacao at 11 cents per lb.	Cost of manuring.	Column A less Column B.
							(A)	(B)	
				*			$ c.	$ c.	$ c.
5	276	150 lb. Sulph. of ammonia 150 lb. ,, ,, potash 1,200 lb. Bone meal	1910-11	38·3					
			1911-12	41·09					
			1912-13	37·95					
			1913-14	45·45					
			1914-15	47·95	10,549	879	96.69	21.41	75.28
6	272	300 lb. Sulph. of potash 1,200 lb. Basic slag	1910-11	41·4					
			1911-12	42·33					
			1912-13	39·15					
			1913-14	44·50					
			1914-15	49·08	10,798	900	99.00	14.89	84.11
7	1116	80 tons Pen manure	1910-11	41·3					
			1911-12	42·68					
			1912-13	42·29					
			1913-14	45·37					
			1914-15	43·81	9,638	803	88.33	34.77	53·56
8	493	125 lb. Sulph. of ammonia 250 lb. ,, ,, potash 2,000 lb. Basic slag	1910-11	19·9					
			1911-12	28·00					
			1912-13	30·54					
			1913-14	37·50					
			1914-15	33·59	7,390	616	67.76	12.95	54.81
9	**398**	**C'ntrol-nomanure**	**1910-11**	**9·8**					
			1911-12	**7·40**					
			1912-13	**5·54**					
			1913-14	**10·36**					
			1914-15	**9·19**	**2,022**	**168**	**18.48**	...	**18.48**

* *Vide* Table I (foot note).

C.—FIELD NO. 9.—The experiments in this field are known as the "Ohlendorff's" plots. The manures, stated below, were applied on February 14, 1914, and the results for this and preceding years are given in Table VI. No forking has been done on these plots.

TABLE VI.—MANURIAL EXPERIMENTS—FIELD NO. 9.

Trees 9 to 10 years old in 1911.

Plot.	Number of bearing trees.	Manures applied per tree *each year from 1911.*	Crop September 1, to August 31.	Average number of pods picked per tree.	Per acre of 300 trees.				
					Number of pods picked.	Lb. dry cacao.	Value of dry cacao at 11 cents per lb.	Cost of manuring.	Column A. less Column B.
				*			(A) $ c.	(B) $ c.	$ c.
1	376	3 lb. Ohlendorff's cacao manure	1911-12	19·59					
			1912-13	35·02					
			1913-14	31·53					
			1914-15	41·08	12,324	1,027	112.97	20.86	92.11
2	**387**	**Control — No manure**	**1911-12**	**11·87**					
			1912-13	**16 78**					
			1913-14	**20·36**					
			1914-15	**23·84**	**7,152**	**596**	**65.56**	**...**	**65.56**
3	393	2 lb. Ohlendorff's cacao manure	1911-12	16·43					
			1912-13	31·97					
			1913-14	30·84					
			1914-15	37·41	11,223	935	102.85	14.01	88.84

All the plots this year show an increase in yield on the previous year and also on crop 1911-12, but the increase from the manured plots is greater than that from the control.

D.—FIELD No. 7.—In 1913, three of the plots in this field on which the natural yield has been recorded for the two previous years, were manured as stated below, plot 10 being kept as a control. The trees are planted 12 feet apart and are situated on a sandy loam at the foot of hilly land. The basic slag and lime were applied on March 16, 1914 and the other manures two months later, but *no forking* was done. The results obtained for the two years are recorded in Table VII.

The heading "probable increase or decrease due to manuring" may require some explanation. The probable increase or decrease due to manuring is the difference between the yield of each plot respectively for the year under review and that of the *natural yield*, of the same plot previous to manuring, to which is added or deducted the decrease or increase shown by the control plot for the same periods. When a manured plot shows a larger increase on its *natural yield* than a control plot it may be assumed that the difference is due to the manures used. Although it is quite evident that all the plots do not show uniform increases or decreases each year (*vide* Natural yield of plots for Fields 2, 3, 4, 5 and 7 pp. 130-132) nevertheless, if the average be taken over a series of years the variation will be greatly reduced.

"Value of decrease due to manuring" means that the cost of the manures and of their application is greater than the value of the increased yield obtained.

TABLE VII.— MANURIAL EXPERIMENTS.—FIELD No. 7.

Trees 10 to 12 years old in 1911.

Plot.	Crop September 1, to August 31.	Number of bearing trees.	Manures applied per acre *each year from 1913.*	AVERAGE NUMBER OF PODS PICKED PER TREE, SEP. 1 TO AUGUST 31.				Per acre of 300 trees.		
				Natural yield 2 years. 1911–12 1912–13.	Yield after manuring.	Increase or decrease on natural yield.	Probable increase or decrease due to manuring.	Value of probable increase or decrease due to manuring at 11c. ℘ lb. dry cacao.	Cost of manuring.	Gain or Loss on control or *no manure plots.*
				*	*	*	*	$ c.	$ c.	$ c.
8	1913–14	49	500 lb. Basic slag 200 ,, Sulphate of ammonia 80 ,, Sulphate of potash	31·54	49·75	+18·21	+8·73	+24.01	14.87	+9.14
	1914–15	49			48·49	+16·95	+13·63	+37.48	14.71	+22.77
9	1913–14	51	500 lb. Lime 200 ,, Sulphate of ammonia 80 ,, Sulphate of potash	36·31	45·57	+9·26	-0·22	-0 60	12.08	-12.68
	1914–15	50			42·22	+5·91	+2·59	+7.12	12.00	-4.88
10	1913–14	46	Control — No manure	41·24	50·72	+9·48	...	...	...	...
	1914–15	46			44·56	+3·32	...	...	...	...

* *Vide* Table I (foot note).

The results obtained for this year show that plot 8 has given an increase of 16·95 pods per tree on its *natural yield*, or 13·63 pods more than the increase obtained from the control plot, and it is probable that this additional increase over the control plot, viz:—13·63 pods per tree, is due to the manures applied. When the cost of manuring is deducted from the value of the probable increase due to manuring, there remains a profit of $22.77 cents on plot 8, but in the case of plot 9, there has been a smaller increase than that from the control plot and consequently a loss of $4.88 is indicated.

SHADE EXPERIMENTS.

E.—SHADE EXPERIMENTS.—These are being made in Fields 5 and 10, and the particulars are given under Tables VIII and IX. As the trees in the *Shade* and *Chupon* experiments are planted at different distances in fields 5 and 10 and in the D and DD series respectively, it is necessary in order to be able to compare the results, to record the yields per acre and not per tree.

TABLE VIII.—SHADE EXPERIMENTS.—FIELD NO. 5.

Trees 25 to 30 years old in 1910.

Plot.	Distance planted.	Treatment.	Number of pods picked per acre of 190 trees.					
			1910–11	1911–12	1912–13	1913–14	1914–15	Average for 5 years 1910–15.
A	15′ x 15′	Full shade ...	9,105	8,666	9,083	9,839	7,608	*8,863*
B*	15′ x 15′	No shade ...	11,575	10,393	8,446	11,284	7,676	*9,889*
C†	15′ x 15′	Partial shade ...	10,179	10,453	9,012	11,794	9,675	*10,222*

* All the Bocare Immortel were cut out and all the Anauco trees barked in July and August, 1910.

† 50 per cent. of the Immortel trees were barked in August, 1910.

All the plots show a decrease for 1914–15 on the crop of the previous year and also on that of 1910–11, *i.e.* the first year on which the experiments were started. The average yield for the five years is given in the last column of the table above. The trees in plot B have now recovered from the damage sustained by the felling and barking of the immortel trees and it will be interesting to note the yield obtained, from each of the plots, in subsequent years compared with the average yield of the first five years. It should be mentioned that the trees in the *no shade* plot B have been more susceptible to attacks of the cacao beetle (*Steirastoma depressum* L.) than those in the shaded plots.

TABLE IX.—SHADE EXPERIMENTS.—FIELD NO. 10.

I.—Trees 7 to 8 years old in 1910. J.—Trees 9 to 10 years old in 1910.

Plot.	Number of bearing trees.	Distance planted.	Treatment.	NUMBER OF PODS PICKED PER ACRE OF 300 TREES.					
				1910–11	1911–12	1912–13	1913–14	1914–15	Av'ge for 5 years 1910–15.
*I	2,051	12′ × 12′	No shade ...	2,715	2,402	3,609	4,612	4,266	*3,492*
J	2,159	12′ × 12′	Full shade...	5,912	4,767	5,121	6,780	6,951	*5,841*

* All the Immortel trees were completely cut out in October and November, 1910.

The yield from the *no shade* plot I shows a decrease of 346 pods per acre on the previous year as against an increase of 171 pods for the full shade plot J. In June 1915 the trees in plot I were more heavily trimmed than usual to admit of more light and air but this trimming would only affect the subsequent crop.

Since the month of October thrips (*Heliothrips rubrocinctus*, Giard) have made their appearance in parts of the *no shade* plot I and as the attack was likely to spread it has been decided, on the recommendation of the Entomologist of the Board of Agriculture, to spray the trees on the affected area with a 2 per cent. solution of lysol.

TABLE X.—YIELD OF INDIVIDUAL TREES IN SHADE EXPERIMENTS.—FIELD NO. 5.

Trees 25 to 30 years old in 1910.

Plot.	Number of trees.	Crop, Sep. 1, to August 31.	PER CENT. TREES BEARING THE FOLLOWING NUMBER OF PODS IN EACH YEAR.						Average number of pods picked per tree.
			0–12.	13-25.	26-50.	51-75.	76–100.	Over 100.	
A. Full Shade	500	1910-11	22·4	19·6	29·0	14·8	5·2	9·0	47·92
	498	1911-12	18·5	19·5	28·1	18·3	5·4	10·2	45·61
	492	1912-13	23·0	15·5	25·8	14·2	7·7	13·8	47·81
	490	1913-14	13·1	14·7	33·3	17·7	8·4	12·8	51·78
	485	1914-15	20·0	22·3	26·0	17·3	9·3	5·1	40·04
Average for 5 years			**19·4**	**18·3**	**28·4**	**16·5**	**7·2**	**10·2**	**46·65**
B. No Shade	500	1910-11	17·0	16·4	25·6	18·0	8·4	14·6	60·92
	500	1911-12	15·2	18·0	27·0	17·0	9·6	13·2	54·70
	493	1912-13	21·9	16·2	27·4	16·1	10·1	8·3	44·45
	485	1913-14	15·7	14·0	24·3	16·5	13·2	16·3	59·39
	479	1914-15	29·2	17·0	22·8	12·7	9·8	8·5	40·40
Average for 5 years			**19·8**	**16·3**	**25·4**	**16·1**	**10·2**	**12·2**	**52·05**
C. Partial Shade	500	1910-11	17·0	16·8	28·0	15·8	12·0	10·4	53·57
	498	1911-12	15·7	14·8	27·1	16·9	10·2	15·3	55·02
	497	1912-13	19·1	16·3	27·8	18·1	7·6	11·1	47·43
	496	1913-14	12·1	10·5	23·2	23·6	11·5	19·1	62·08
	496	1914-15	17·1	15·7	25·2	18·6	10·7	12·7	50·92
Average for 5 years			**16·2**	**14·8**	**26·3**	**18·6**	**10·4**	**13·7**	**53·80**

The shade and chupon experiments are made in order to ascertain what is desirable and what is undesirable in these methods of cultivation. The results obtained up to the present time are published, but the Department is not yet in a position to express a definite opinion on these methods which have given rise to much discussion during a great number of years.—P.C.

CHUPON EXPERIMENTS.

F.—CHUPON EXPERIMENTS.—The results of the chupon experiments are recorded in Tables XI and XII. As in the case of the shade experiments the average yield for the past five years is shown in the last column of the tables.

TABLE XI.—CHUPON EXPERIMENTS.—FIELD NO. 8.

Trees 9 to 10 years old in 1910.

Plot.	Distance planted.	Treatment.	NUMBER OF PODS PICKED PER ACRE OF 300 TREES.					
			1910–11.	1911–12.	1912–13.	1913–14.	1914–15.	Average for 5 years 1910–15.
D.	12′×12′	All chupons allowed to grow	8,892	9,702	8,640	11,184	10,416	*9,768*
E.	12′×12′	3 ,, ,, ...	7,512	12,132	11,197	13,028	11,829	*11,124*
F.	12′×12′	2 ,, ,, ...	8,025	12,479	12,206	12,970	11,898	*11,505*
G.	12′×12′	1 chupon ,, ...	11,061	13,842	11,318	13,354	12,300	*12,375*
H.	12′×12′	No chupons ,, ...	10,461	13,215	12,753	13,179	12,060	*12,333*

TABLE XII.—CHUPON EXPERIMENTS.—FIELD NO. 8.

Trees 25 to 30 years old in 1910.

Plot.	Distance planted.	Treatment.	NUMBER OF PODS PICKED PER ACRE OF 190 TREES.					
			1910–11.	1911–12.	1912–13.	1913–14.	1914–15.	Average for 5 years 1910–15.
D.D.	15′×15′	All chupons allowed to grow	10,898	14,248	12,486	12,548	12,745	*12,584*
E.E.	15′×15′	3 ,, ,, ,, ...	8,860	12,274	11,108	12,525	12,967	*11,541*
F.F.	15′×15′	2 ,, ,, ,, ...	7,921	9,448	7,838	8,360	9,667	*8,645*
G.G.	15′×15′	1 chupon ,, ,, ...	8,290	10,876	11,148	11,956	14,229	*11,257*
H.H.	15′×15′	No chupons ,, ,, ...	10,613	14,670	12,899	14,157	13,372	*13,140*

The object of these experiments as stated in previous reports is to see to what extent the yield will be affected by allowing all, or some, or no chupons to grow.

TABLE XIII.—YIELD OF INDIVIDUAL TREES IN CHUPON EXPERIMENTS—FIELD NO. 8.

Trees planted 12' x 12' Age 9 to 10 years in 1910.

Plot.	Number of trees.	Crop, Sept. 1, to August 31.	PER CENT. TREES BEARING THE FOLLOWING NUMBER OF PODS IN EACH YEAR.						Average number of pods picked per tree.
			0-12.	13-25.	26-50.	51-75.	76-100.	over 100.	
D. All Chupons	100	1910-11	25·0	27·0	33·0	11·0	3·0	1·0	29·64
	100	1911-12	21·0	19·0	38·0	19·0	1·0	2·0	32·34
	100	1912-13	30·0	23·0	30·0	13·0	3·0	1·0	28·80
	100	1913-14	17·0	25·0	29·0	22·0	3·0	4·0	37·28
	100	1914-15	26·0	25·0	22·0	15·0	10·0	2·0	34·72
Average for 5 years			**23·8**	**23·8**	**30·4**	**16·0**	**4·0**	**2·0**	**32·56**
E. Three Chupons	100	1910-11	23·0	40·0	26·0	8·0	3·0	...	25·04
	100	1911-12	16·0	21·0	34·0	17·0	7·0	5·0	40·44
	99	1912-13	18·2	23·2	30·3	18·2	7·1	3·0	37·32
	98	1913-14	11·2	17·3	42·9	17·4	4·1	7·1	43·43
	95	1914-15	16·8	22·1	31·6	17·9	6·3	5·3	39·43
Average for 5 years			**17·0**	**24·7**	**33·0**	**15·7**	**5·5**	**4·1**	**37·08**
F. Two Chupons	100	1910-11	26·0	30·0	33·0	9·0	2·0	...	26·75
	99	1911-12	18·2	16·2	36·4	14·1	10·1	5·0	41·30
	99	1912-13	16·1	28·3	26·3	16·2	5·0	8·1	40·69
	98	1913-14	12·3	20·4	32·6	20·4	8·2	6·1	43·23
	98	1914-15	15·3	22·5	35·7	17·3	5·1	4·1	39·66
Average for 5 years			**17·6**	**23·5**	**32·8**	**15·4**	**6·1**	**4·6**	**38·35**
G. One Chupon	100	1910-11	14·0	24·0	39·0	15·0	2·0	6·0	36·87
	100	1911-12	18·0	12·0	34·0	19·0	9·0	8·0	46·14
	99	1912-13	27·3	23·2	24·2	11·1	7·1	7·1	37·73
	99	1913-14	22·2	16·2	24·2	18·2	10·1	9·1	44·51
	98	1914-15	24·5	22·5	21·4	14·3	11·2	6·1	41·00
Average for 5 years			**21·2**	**19·6**	**28·6**	**15·5**	**7·9**	**7·2**	**41·25**
H. No Chupons	100	1910-11	20·0	15·0	40·0	19·0	4·0	2·0	34·87
	100	1911-12	14·0	17·0	29·0	29·0	5·0	6·0	44·05
	100	1912-13	16·0	22·0	34·0	15·0	5·0	8·0	42·51
	100	1913-14	18·0	10·0	32·0	27·0	9·0	4·0	43·93
	100	1914-15	23·0	14·0	31·0	17·0	10·0	5·0	40·20
Average for 5 years			**18·2**	**15·6**	**33·2**	**21·4**	**6·6**	**5·0**	**41·11**

TABLE XIV.—YIELD OF INDIVIDUAL TREES IN CHUPON EXPERIMENTS.—FIELD No. 8.

Trees planted 15′ × 15′—Age 25 to 30 years in 1910.

Plot.	Number of trees.	Crop, Sep. 1, to August 31.	PER CENT. TREES BEARING THE FOLLOWING NUMBER OF PODS IN EACH YEAR.						Average number of pods picked per tree.
			0-12.	13-25.	26-50.	51-75.	76-100.	Over 100.	
D.D. All Chupons	100	1910–11	11·0	15·0	28·0	19·0	10·0	17·0	57·36
	100	1911–12	8·0	7·0	25·0	20·0	18·0	22·0	74·99
	99	1912–13	8·1	11·1	24·2	23·2	16·2	17·2	65·72
	99	1913–14	7·0	8·1	28·3	27·3	12·1	17·2	66·04
	98	1914–15	8·2	12·2	26·5	19·4	13·3	20·4	67·08
Average for 5 years...			**8·5**	**10·7**	**26·4**	**21·7**	**13·9**	**18·8**	**66·23**
E.E. Three Chupons	100	1910–11	18·0	16·0	31·0	19·0	7·0	9·0	46·63
	100	1911–12	15·0	12·0	21·0	18·0	11·0	23·0	64·60
	99	1912–13	14·2	14·1	26·3	20·2	11·1	14·1	58·46
	99	1913–14	5·1	15·1	27·3	13·1	21·2	18·2	65·92
	98	1914–15	6·1	14·3	27·6	19·4	10·2	22·4	68·25
Average for 5 years...			**11·7**	**14·3**	**26·6**	**17·9**	**12·1**	**17·4**	**60·74**
F.F. Two Chupons	100	1910–11	20·0	18·0	29·0	16·0	13·0	4·0	41·69
	99	1911–12	14·1	20·2	25·3	19·2	10·1	11·1	49·73
	99	1912–13	26·3	20·2	25·2	12·1	6·1	10·1	41·25
	99	1913–14	18·2	19·2	27·3	18·2	10·1	7·0	44·45
	99	1914–15	15·2	21·2	29·3	10·1	10·1	14·1	50·88
Average for 5 years...			**18·8**	**19·8**	**27·2**	**15·1**	**9·9**	**9·2**	**45·50**
G.G. One Chupon	100	1910–11	17·0	24·0	28·0	16·0	9·0	6·0	43·63
	98	1911–12	13·3	14·3	25·5	16·3	15·3	15·3	57·24
	95	1912–13	9·5	17·9	25·3	23·1	8·4	15·8	58·67
	94	1913–14	9·6	12·8	29·8	8·5	20·2	19·1	62·92
	94	1914–15	9·6	10·6	18·1	22·4	13·8	25·5	74·89
Average for 5 years..			**11·8**	**15·9**	**25·4**	**17·3**	**13·3**	**16·3**	**59·25**
H.H. No Chupons	100	1910–11	13·0	15·0	23·0	28·0	8·0	13·0	55·86
	100	1911–12	9·0	5·0	28·0	16·0	16·0	26·0	77·21
	100	1912–13	17·0	5·0	25·0	22·0	8·0	23·0	67·89
	100	1913–14	9·0	8·0	24·0	23·0	15·0	21·0	74·51
	98	1914–15	11·2	9·2	21·4	24·5	14·3	19·4	70·38
Average for 5 years...			**11·8**	**8·4**	**24·3**	**22·7**	**12·3**	**20·5**	**69·16**

NATURAL YIELD OF PLOTS.

The results of the *natural yield* plots for this and previous years are given in the tables below and they are also shown in diagram vi.

TABLE XV.—NATURAL YIELD OF PLOTS.

AVERAGE NUMBER OF PODS PICKED PER TREE.

Plot.	Field No. 2. Trees planted 15′ × 15′—27 to 32 years old in 1912.		Field No. 3. Trees planted 15′ × 15′—27 to 32 years old in 1912.		Field No. 4. Trees planted 15′ × 15′—27 to 32 years old in 1912.		Field No. 5. Trees planted 15′ × 15′—27 to 32 years old in 1912.		Field No. 7. Trees planted 12′ × 12′—10 to 12 years old in 1911.	
	Av'ge. for 2 years 1912–14	1914–15	Av'ge. for 2 years 1912–14	1914–15	Av'ge. for 2 years 1912–14	1914–15	Av'ge. for 2 years 1912–14	1914–15	Av'ge. for 3 years 1911–14	1914–15
	*	*	*	*	*	*	*	*	*	*
1	31·04	30·20	24·80	22·65	24·83	21·77	38·40	37·39	14·68	20·32
2	32·43	33·22	35·11	23·63	41·99	35·67	27·27	29·28	25·92	35·33
3	30·65	39·49	25·09	20·32	33·53	32·06	27·51	24·71	28·05	41·37
4	21·91	24·41	27·37	20·78	37·91	28·87	29·92	27·36	17·14	31·50
5	33·39	37·64	23·30	18·05	28·13	23·46	24·23	18·45	24·65	34·12
6	23·00	24·63	15·47	12·92	38·45	34·99	...	...	27·74	42·35
7	20·92	25·15	18·01	13·66	47·49	45·58	...	...	29·07	40·97
8	27·14	27·44	...	...	...	...	...	...	...	...

From the figures recorded in this table it will be seen that the yield obtained in the different fields does not show any uniform variation. There has been a decrease for one plot only in field 2 whereas all the plots in fields 3 and 4 show a decrease. In field 5, one plot only has given an increase and in field 7 there has been a fairly large increase from all of the plots.

The increase or decrease in the crop of each plot compared with previous years is shown in Table XVI. A minus sign (–) indicates a decrease, the figures without any sign in front indicate increases. The results are expressed as pods picked per tree.

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* *Vide* Table I (foot note.)

TABLE XVI.—NATURAL YIELD OF PLOTS, SHOWING THE INCREASE OR DECREASE OF CROP 1914–15 ON AVERAGE OF PREVIOUS CROPS.

Plot.	FIELD NO. 2.	FIELD NO. 3.	FIELD NO. 4.	FIELD NO. 5.	FIELD NO. 7.
	Increase or decrease on average of crops 1912–14.—2 years.	Increase or decrease on average of crops 1912–14.—2 years.	Increase or decrease on average of crops 1912–14.—2 years.	Increase or decrease on average of crops 1912–14.—2 years.	Increase or decrease on average of crops 1911–14.—3 years.
	PODS PER TREE				
	*	*	*	*	*
1	-0·84	-2·15	-3·06	-1·01	5·64
2	0·79	-11·48	-6·32	2·01	9·41
3	8·84	-4·77	-1·47	-2·80	13·32
4	2·50	-6·59	-9·04	-2·56	14·36
5	4·25	-5·25	-4·67	-5·78	9·47
6	1·63	-2·55	-3·46	...	14·61
7	4·23	-4·35	-1·91	...	11·90
8	0·30	...	...	...	...

The results recorded in tables XV and XVI, have been obtained without the application of any manures, and as far as each field is concerned the cultivation of the plots has been identical. The difference therefore between the yield of one crop and another is undoubtedly due to seasons, and to the increasing age of the trees, (when these have not yet attained their full bearing capacity) although the increase in yield from the latter cause may not be very marked from one year to the next.

The variation in the yield between the various plots in each field for the same crop, is due to the relative productiveness of the particular group of trees forming each plot and is largely dependent on the relative proportion of heavy and poor bearing trees thereon (*vide* Tables XVIII to XXII). It will also be observed that these differences are not uniform, that is, the plots do not increase or decrease in the same proportion from one year to another, and it is advisable to keep the records for several years more to ascertain whether these differences will not become more uniform when known for a longer series of years.

These facts further tend to prove the statement made in previous reports, viz.:—that in order to be able to arrive more readily at reliable conclusions as to the relative value of different manures applied to cacao trees, it is necessary to ascertain the natural yield of the plots over a series of years, previous to the application of the manures.

It is interesting to record the difference between the highest and the lowest yielding plots in each field. The figures for this and the average of two previous years are shown in Table XVII.

Vide Table I (foot note.)

TABLE XVII.—NATURAL YIELD OF PLOTS.

	Average Number of Pods Picked per Tree.									
	Field No. 2.		Field No. 3.		Field No. 4.		Field No. 5.		Field No. 7.	
	Average for 2 y'rs 1912–14.	1914–15.	Average for 2 y'rs 1912–14.	1914–15.	Average for 2 y'rs 1912–14.	1914–15.	Average for 2 y'rs 1912–14.	1914–15.	Average for 3 y'rs 1911–14.	1914–15.
	*	*	*	*	*	*	*	*	*	*
Highest ...	33·39	39·49	35·11	23·63	47·49	45·58	38·40	37·39	29·07	42·35
Lowest ...	20·92	24·41	15·47	12·92	24·83	21·77	24·23	18·45	14·68	20·32
Difference ...	12·47	15·08	19·64	10·71	22·66	23·81	14·17	18·94	14·39	22 03

It is evident from these figures that it would be absolutely erroneous to consider any one plot as a control for any series of plots.

NATURAL YIELD OF INDIVIDUAL TREES.

All the trees in the *natural yield* plots in fields 2, 3, 4, 5 and 7—approximately 6,257 trees—have been labelled and the number of pods picked from each tree recorded. The returns are interesting, and the percentage of trees in each plot bearing less than 13 pods per tree annually, from 13 to 25 pods per tree, &c., from each field respectively, has been calculated. The results obtained are given in Tables XVIII to XXII.

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* *Vide* Table I (foot note.)

TABLE XVIII.—NATURAL YIELD OF INDIVIDUAL TREES.—FIELD No. 2.

Trees 27 to 32 years old in 1912.

Plot.	Number of trees.	Crop, Sep. 1, to August 31.	PER CENT. TREES BEARING THE FOLLOWING NUMBER OF PODS IN EACH YEAR.						Average number of pods picked per tree.
			0-12.	13-25.	26-50.	51-75.	76-100.	Over 100.	
1	298	1912–13	48·7	18·8	18·4	6·0	4·4	3·7	24·98
	290	1913–14	34·1	15·9	24·8	9·7	6·2	9·3	37·27
	287	1914–15	37·3	18·5	23·7	12·1	4·9	3·5	30·20
2	382	1912–13	43·5	20·7	19·4	9·4	4·4	2·6	26·58
	374	1913–14	29·1	19·5	24·9	11·2	7·3	8·0	38·41
	366	1914–15	32·8	19·4	24·3	12·0	6·3	5·2	33·22
3	209	1912–13	42·6	20·1	22·9	7·2	4·8	2·4	26·05
	208	1913–14	27·4	21·6	27·9	12·0	5·3	5·8	35·28
	206	1914–15	29·6	17·5	23·8	16·5	3·9	8·7	39·49
4	398	1912–13	58·5	20·9	14·8	5·0	0·5	0·3	15·81
	396	1913–14	38·6	17·2	22·7	14·7	4·0	2·8	28·04
	393	1914–15	41·2	21·1	24·2	8·7	3·3	1·5	24·41
5	387	1912–13	42·1	23·3	19·1	8·8	4·4	2·3	25·99
	386	1913–14	21·3	20·2	31·6	12·4	6·7	7·8	40·82
	385	1914–15	26·0	23·6	22·3	14·3	6·8	7·0	37·64
6	384	1912–13	61·5	19·3	12·2	3·9	2·1	1·0	15·84
	378	1913–14	42·1	15·4	22·2	11·9	3·4	5·0	30·28
	365	1914–15	46·0	18·4	20·5	8·5	3·3	3·3	24·63
7	321	1912–13	64·5	16·5	11·8	5·3	1·6	0·3	15·30
	318	1913–14	44·3	17·6	19·8	9·8	4·7	3·8	26·59
	310	1914–15	45·2	18·7	20·3	9·4	3·2	3·2	25·15
8	338	1912–13	48·2	23·1	18·9	5·6	3·3	0·9	21·32
	338	1913–14	25·4	23·7	28·7	12·4	5·9	3·9	32·96
	336	1914–15	35·7	26·2	21·1	10·4	3·6	3·0	27·44
Average for 3 years for the whole Field			**40·2**	**19·9**	**21·7**	**9·9**	**4·3**	**4·0**	

TABLE XIX.—NATURAL YIELD OF INDIVIDUAL TREES.—FIELD NO. 3.

Trees 27 to 32 years old in 1912.

Plot.	Number of trees.	Crop, Sep. 1, to Aug. 31.	PER CENT. TREES BEARING THE FOLLOWING NUMBER OF PODS IN EACH YEAR.						Average No. of pods picked per tree.
			0-12	13-25	26-50	51-75	76-100	Over 100	
1	208	1912-13	54·8	15·4	22·1	6·2	0·5	1·0	17·27
	204	1913-14	32·4	19·1	23·0	16·7	4·4	4·4	32·46
	199	1914-15	46·7	22·1	18·6	9·1	2·5	1·0	22·65
2	235	1912-13	40·4	22·1	24·3	8·1	0·4	4·7	26·40
	231	1913-14	28·1	13·8	26·0	16·9	6·1	9·1	43·97
	229	1914-15	47·2	21·0	19·6	8·3	1·3	2·6	23·63
3	220	1912-13	55·5	17·7	17·3	5·0	2·7	1·8	19·64
	216	1913-14	33·8	23·6	22·2	11·1	6·5	2·8	30·64
	210	1914-15	53·8	22·4	12·4	5·7	2·4	3·3	20·23
4	243	1912-13	43·6	23·9	20·2	9·0	2·5	0·8	21·97
	239	1913-14	33·9	17·6	25·1	13·0	6·7	3·7	32·87
	238	1914-15	52·1	19·8	16·4	8·4	2·9	0·4	20·78
5	221	1912-13	56·1	18·5	16·7	4·1	1·4	3·2	19·56
	217	1913-14	39·2	23·0	20·3	9·7	5·5	2·3	27·12
	215	1914-15	56·3	21·4	13·5	5·6	1·8	1·4	18·05
6	225	1912-13	71·5	13·8	10·7	1·8	1·8	0·4	11·71
	219	1913-14	55·7	15·1	19·2	5·5	2·7	1·8	19·35
	217	1914-15	67·3	17·0	11·5	2·3	0·5	1·4	12·92
7	208	1912-13	61·5	14·0	16·8	5·8	1·4	0·5	15·42
	203	1913-14	56·7	14·3	16·7	5·9	4·4	2·0	20·67
	197	1914-15	69·0	11·2	13·7	3·1	2·0	1·0	13·66
Average for 3 years for the whole Field			**50·3**	**18·4**	**18·4**	**7·7**	**2·9**	**2·3**	

TABLE XX.—NATURAL YIELD OF INDIVIDUAL TREES.—FIELD NO. 4.

Trees 27 to 32 years old in 1912.

Plot.	Number of trees.	Crop, Sep. 1, to Aug. 31.	PER CENT. TREES BEARING THE FOLLOWING NUMBER OF PODS IN EACH YEAR.						Average No. of pods picked per tree.
			0–12	13–25	26–50	51–75	76–100	Over 100	
1	186	1912–13	37·6	28·0	21·5	7·5	4·3	1·1	24·47
	184	1913–14	36·9	22·3	27·2	8·7	3·3	1·6	25·19
	183	1914–15	46·4	23·0	20·2	7·1	2·2	1·1	21·77
2	174	1912–13	25·9	21·8	23·5	16·1	7·5	5·2	37·78
	174	1913–14	26·4	13·2	29·3	10·4	6·9	13·8	46·20
	174	1914–15	28·8	17·8	27·6	13·2	8·0	4·6	35·67
3	184	1912–13	31·5	22·8	25·5	10·9	7·1	2·2	31·15
	183	1913–14	24·6	23·5	27·3	15·3	2·7	6·6	35·92
	183	1914–15	30·6	22·9	24·0	12·6	6·6	3·3	32·06
4	164	1912–13	30·5	23·8	20·7	10·4	7·9	6·7	37·90
	164	1913–14	32·3	18·3	25·0	12·2	4·9	7·3	37·92
	164	1914–15	36·6	23·8	21·9	10·4	5·5	1·8	28·87
5	176	1912–13	47·2	19·9	17·0	8·5	5·1	2·3	25·00
	176	1913–14	38·6	22·2	21·0	6·8	4·0	7·4	31·26
	168	1914–15	50·0	16·1	19·6	7·1	4·8	2·4	23·46
6	195	1912–13	34·3	23·6	23·1	7·7	4·6	6·7	33·03
	193	1913–14	23·8	21·2	24·3	13·0	7·3	10·4	43·93
	192	1914–15	31·2	24·5	20·3	12·5	4·2	7·3	34·99
7	186	1912–13	23·7	19·9	29·0	12·4	5·9	9·1	39·92
	184	1913–14	16·3	10·9	28·2	21·2	8·2	15·2	55·16
	182	1914–15	17·6	18·7	27·5	18·1	11·0	7·1	45·58
Average for 3 years for the whole Field			31·9	20·9	24·0	11·5	5·8	5·9	

TABLE XXI.—NATURAL YIELD OF INDIVIDUAL TREES.—FIELD NO. 5.

Trees 27 to 32 years old in 1912.

Plot.	Number of trees.	Crop, Sep. 1, to August 31.	PER CENT. TREES BEARING THE FOLLOWING NUMBER OF PODS IN EACH YEAR.						Average number of pods picked per tree.
			0-12.	13-25.	26-50.	51-75.	76-100.	Over 100.	
1	88	1912–13	40·9	13·7	26·1	9·1	1·1	9·1	34·25
	88	1913–14	31·8	18·2	22·7	10·2	8·0	9·1	42·56
	88	1914–15	34·1	18·2	21·6	13·6	5·7	6·8	37·39
2	80	1912–13	51·3	17·5	15·0	11·2	2·5	2·5	22·76
	80	1913–14	40·0	15·0	22·5	11·3	7·5	3·7	31·79
	80	1914–15	44·1	13·0	26·0	7·8	5·2	3·9	29·28
3	98	1912–13	48·0	19·4	22·4	6·1	4·1	...	20·83
	98	1913–14	29·6	21·4	27·6	12·2	5·1	4·1	34·20
	96	1914–15	45·8	18·8	21·9	6·2	4·2	3·1	24·71
4	82	1912–13	45·1	26·8	18·3	6·1	3·7	...	20·18
	81	1913–14	28·4	16·0	27·2	12·3	9·9	6·2	39·78
	81	1914–15	40·7	18·5	23·5	8·6	5·0	3·7	27·36
5	113	1912–13	55·7	20·3	14·2	6·2	1·8	1·8	18·31
	112	1913–14	44·6	15·2	23·2	5·4	4·5	7·1	30·20
	112	1914–15	63·4	13·4	11·6	5·3	4·5	1·8	18·45
Average for 3 years for the whole Field			42·9	17·7	21·6	8·8	4·8	4·2	

TABLE XXII.—NATURAL YIELD OF INDIVIDUAL TREES.—FIELD NO. 7.

Trees 11 to 13 years old in 1912.

Plot.	Number of trees.	Crop, Sep. 1, to Aug. 31.	PER CENT. TREES BEARING THE FOLLOWING NUMBER OF PODS IN EACH YEAR.						Average number of pods picked per tree.
			0-12.	13-25.	26-50.	51-75.	76-100.	Over 100.	
1	47	1912–13	51·1	25·5	19·1	4·3	...	...	16·98
	44	1913–14	52·3	29·5	13·6	4·6	...	...	16·02
	43	1914–15	37·2	32·6	23·3	4·6	2·3	...	20·32
2	46	1912–13	26·1	19·6	39·1	6·5	6·5	2·2	32·39
	46	1913–14	32·6	28·3	21·7	15·2	2·2	...	26·02
	46	1914–15	17·4	21·7	37·0	15·2	6·5	2·2	35·33
3	44	1912–13	29·5	20·5	27·3	20·4	...	2·3	31·79
	42	1913–14	31·0	28·6	23·8	7·1	7·1	2·4	29·33
	38	1914–15	26·3	10·5	29·0	13·2	18·4	2·6	41·37
4	50	1912–13	48·0	14·0	24·0	12·0	...	2·0	23·30
	50	1913–14	46·0	30·0	22·0	2·0	...	...	16·50
	50	1914–15	36·0	10·0	30·0	18·0	4·0	2·0	31·50
5	51	1912–13	37·2	25·5	21·6	9·8	5·9	...	26·76
	50	1913–14	26·0	30·0	30·0	8·0	...	6·0	31·30
	50	1914–15	28·0	20·0	32·0	14·0	4·0	2·0	34·12
6	51	1912–13	21·6	27·5	33·3	13·7	3·9	...	30·80
	50	1913–14	20·0	16·0	44·0	12·0	4·0	4·0	35·00
	49	1914–15	12·3	16·3	42·9	20·4	2·0	6·1	42·35
7	46	1912–13	26·1	8·7	41·3	15·2	6·5	2·2	34·61
	43	1913–14	27·9	25·6	27·9	11·6	7·0	...	30·77
	39	1914–15	18·0	18·0	25·6	33·3	...	5·1	40·97
Average for 3 years for the whole Field			**31·0**	**21·8**	**29·0**	**12·4**	**3·8**	**2·0**	

TABLE XXIII.—COMPARATIVE RETURN OF PERCENTAGE OF TREES BEARING THE INDICATED NUMBER OF PODS IN EACH YEAR, BASED AS AVERAGES IN TABLES XVIII TO XXII.

Field.	Age of trees in 1912.	No. of years of observation.	Percentage of Trees Bearing the following Number of Pods.					
			0–12.	13–25.	26–50.	51–75.	76–100.	Over 100.
No. 2 ...	27–32	3	40·2	19·9	21·7	9·9	4·3	4·0
,, 3 ..	27–32	3	50·3	18·4	18·4	7·7	2·9	2·3
,, 4 ...	27–32	3	31·9	20·9	24·0	11·5	5·8	5·9
,, 5 ...	27–32	3	42·9	17·7	21·6	8·8	4·8	4·2
,, 7 ...	11–13	3	31·0	21·8	29·0	12·4	3·8	2·0

The figures recorded in Tables XVIII to XXII show:—

1. That a large proportion of the trees in these fields has given less than 13 pods or a pound of dry cacao per annum during the past three years.

2. That although a favourable season (1913-14) considerably reduces the percentage of trees bearing less than a pound of dry cacao per annum, the proportion of these during the past three years for the above fields is not less than 30 per cent. on an average.

3. That the comparative yield of the plots in each field for each year is largely dependent on the relative proportion of high and low bearing trees thereon and that generally the percentage of trees bearing less than 13 pods per tree appears to exert the largest influence on the relative yield of the plots.

Generally, it has been observed that the heavy bearing trees of the first year have continued to be heavy bearers, and that the poor yielding trees have remained poor during the following years. The detection of poor bearing trees on an estate, and their subsequent replacement with trees raised from stock, or budded or grafted trees of known prolific and other qualities, is deserving of serious consideration. The advisability of improving the crop of poor yielding fields on an estate, by replacing the trees which bear an average of less than 13 pods annually, appears to be clearly indicated and should form part of the experiments to be made later on the *natural yield* plots.

Brooklyn Estate.

CACAO EXPERIMENTS.

The treatment accorded to each plot and the results obtained for this and previous years are recorded in Table XXIV. The manures were applied in March, 1914 and the rainfall in the district for the twelve months from May 1, 1914 to April 30, 1915 was 90·57 inches.

All the plots show a decrease in yield on the previous crop and only plots 8, 9, 10 and 11 have given an increase on crop 1911-12. Nevertheless, 342 pounds more of dry cacao have been reaped than in 1911-12.

TABLE XXIV—MANURIAL EXPERIMENTS—BROOKLYN ESTATE.

Trees 18 to 20 years old in 1911.

Plot.	Manures applied per tree *each year from 1911.*	Average number of pods picked per tree.			YIELD—SEP. 1, 1914 TO AUG. 31, 1915.					
					Average Number of pods picked per tree.	Per acre of 258 trees.				
		1911-12.	1912-13.	1913-14.		Number of pods picked.	Lb. Dry Cacao.	Value of dry cacao at 11c. per lb.	Cost of manuring.	Col. A less Col. B.
		*	*	*	*			(A) $ c.	(B) $ c.	$ c.
1A	120 lb. Pen manure ...	23·66	22·82	27·04	19·07	4,920	410	45.10	19.20	25.90
1B	5 lb. Sheep manure 4 ,, Basic slag ½ ,, Sulph. of potash	31·75	38·75	40·10	25·45	6,566	547	60.17	20.18	39.99
2	**Control—No manure**	**21·21**	**22·86**	**27·02**	**18·57**	**4,791**	**399**	**43.89**	...	**43.89**
3	5 lb. Sheep manure 2 ,, Dissolved bones	24·68	27·23	29·96	19·61	5,059	422	46.42	14.58	31.84
4	**Control—No manure**	**16·45**	**17·30**	**21·53**	**15·98**	**4,123**	**343**	**37.73**	...	**37.73**
5	3 lb. Lime	16 53	19·10	21·39	16·54	4,267	355	39.05	3.44	35.61
6	5 lb. Sheep manure 2 ,, Dissolved bones ½ ,, Sulph. of potash	18·40	24·29	24·62	15·05	3,883	323	35.53	17.61	17.92
7†	4 lb. Basic slag 1 ,, Sulphate of potash	27·96	32·67	33·50	21·56	5,562	463	50.93	17.31	33.62
8	**Control—No manure**	**16·63**	**22·68**	**26·53**	**20·61**	**5,317**	**443**	**48.73**	...	**48.73**
9‡	3 lb. Lime 1 ,, Dissolved bones	16·50	21·95	27·83	18·61	4,801	400	44.00	7.75	36.25
10	**Control—No manure**	**16·11**	**19·24**	**21·68**	**16·94**	**4,370**	**364**	**40.04**	...	**40.04**
11	2 lb. Bone meal ½ ,, Sulph. of ammonia ½ ,, Sulph. of potash	22·73	24·85	34·01	24·15	6,231	519	57.09	16.81	40.28

* *Vide* Table I (foot note).

† Applied in two equal dressings at an interval of three months.

‡ Dissolved bones applied three months after the lime.

Tobago Estates.

CACAO AND RUBBER EXPERIMEMTS.

RICHMOND ESTATE.—(MIXED CACAO AND CASTILLOA RUBBER.

The plots received the same treatment as in previous years, except plot 5, to which no pen manure was applied. The artificial manures were applied on April 3, and the mulch in September 1914. None of the plots were forked this year.

The yield from the cacao trees for this and previous years is recorded in Table XXVI.

The rubber trees were measured on May 26, 1915, and the average girth of the trees for each plot is recorded in Table XXV, but the trees were not tapped owing to the low price of rubber.

TABLE XXV.—CACAO AND RUBBER EXPERIMENTS.—RICHMOND ESTATE.

Trees 12 years old in 1911.

Plot.	Description of trees.	Number of bearing trees.	Per Plot.		AVERAGE GIRTH OF RUBBER TREES 3 FEET ABOVE THE GROUND.				
			Manures applied *each year from 1911.*	Cost of manuring.	Measured Oct., 1911.	Measured Mar., 1912.	Measured June, 1913.	Measured Mar., 1914.	Measured May, 1915.
				$ c.	Ins.	Ins.	Ins.	Ins.	Ins.
1	Cacao ...	92	188 lb. Bone meal 94 ,, Sulph. of ammonia 47 ,, Sulph. of potash	6.61	...	...	...	...	...
	Rubber ...	13		0.93	39·9	42·1	44·1	45·3	46·4
2	Cacao ...	88	180 lb. Basic slag ...	2.50	...	...	...	...	...
	Rubber ...	13	45 ,, Sulph. of potash ...	0.37	42·9	45·0	46·9	48·2	48·9
3	Cacao ...	81	Control-No manure	...	42·6	44·0	45·3	46·5	46·6
	Rubber.	9							
4	Cacao ...	78	8,300 lb. Mulch 83 ,, Sulph. of ammonia 45 ,, Sulph of potash	9.16	...	...	...	...	...
	Rubber ...	11		1.29	41·9	43·9	45·0	46·0	46·8
* 5	Cacao ...	76	6,600 lb. Pen manure	...	...	...	...	...	...
	Rubber ...	13		...	36·1	39·3	41·5	43·2	45·4

* No pen manure applied in 1914.

TABLE XXVI—YIELD OF CACAO FROM RICHMOND ESTATE PLOTS.

Plot.	Average Number of pods picked per tree.			Yield : September 1, 1914 to August 31, 1915.					
				Average number of pods picked per tree.	Per acre of 300 trees.				
	1911-12.	1912-13.	1913-14.		Number of pods picked.	Lb. dry cacao.	Value of dry cacao at 11c. per lb.	Cost of manuring.	Col. (A) less Col. (B.)
	*	*	*	*			(A)	(B)	
							$ c.	$ c.	$ c.
1	35·35	32·52	29·76	30·78	9,234	769	84.59	21.57	63.02
2	28·66	27 72	26·40	32·62	9,786	815	89.65	8.52	81.13
3	**26·08**	**21·30**	**20·72**	**28·22**	**8,466**	**705**	**77.55**	..	**77.55**
4	28·91	25·78	28·36	41·96	12,588	1,049	115.39	35.22	80.17
5	36·50	30·66	31·43	42·12	12,636	1,053	115.83	...	115.83

All the plots have given an increase on the previous year's yield but plots 4 and 5 have given a larger increase than the control plot and 2,365 pods more have been reaped per acre from the average of the manured plots against 2,250 pods more from the control plot.

Compared with 1911-12, plots 2, 3, 4 and 5 have given an increase in yield but the increase from plots 2, 4 and 5 is larger than that from the control plot. The increase from the control plot is 642 pods per acre against 1,355 pods from the average of the manured plots.

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* *Vide* Table I (foot note.)

ROXBOROUGH ESTATE.—(Mixed Hevea, Castilloa and Funtumia Rubber).

No manures were applied this year as the trees have shaded the ground to such an extent that the wild indigo in plot 3 had failed to grow during the previous year. The girth of the trees was measured on April 17, 1915, the average for each plot has been calculated and the results are recorded in Table XXVII.

TABLE XXVII.—RUBBER EXPERIMENTS.—ROXBOROUGH ESTATE, TOBAGO.

Trees about 5 years old in 1911.

Plot.	Description of trees.	Number of trees.	Manures applied per tree each year from 1911 to 1914.	AVERAGE GIRTH OF TREES 3 FT. ABOVE THE GROUND.				
				Mar., 1911.	Mar., 1912.	May, 1913.	Mar., 1914.	Apl., 1915.
				Ins.	Ins.	Ins.	Ins.	Ins.
1	Hevea ...	10	100 lb. Pen manure ...	6·5	9·8	15·2	17·8	23·8
	Castilloa ...	11		15·2	19·2	24·4	27·9	30·9
	Funtumia ...	10		4·3	6·0	7·7	8·7	9·5
2	Hevea ...	9	2 lb. Sulph. of ammonia 1 ,, Sulph. of potash	4·9	7·9	13·0	15·7	22·4
	Castilloa ...	10		14·7	20·9	28·4	31·1	34·0
	Funtumia ...	5		4·1	5·8	8·3	10·0	12·1
3	Hevea ...	9	Wild indigo planted for shading the ground	7·1	10·7	17·5	19·6	25·8
	Castilloa ...	10		19·0	22·7	28·7	30·5	33·4
	Funtumia ...	7		5·0	6·9	9·5	12·0	12·6
4	Hevea ...	5	Mulch	8·0	12·2	18·6	21·0	24·6
	Castilloa ...	9		20·0	25·8	32·5	33·8	36·5
	Funtumia ...	7		7·0	8·4	11·2	12·3	14·1
5	Hevea ..	7	Control—No manure	3·3	5·3	10·4	11·4	16·1
	Castilloa	12		15·1	20·4	26·1	28·3	31·6
	Funtumia	9		7·1	9·6	13·0	14·2	16·4

The average girth of the Hevea, Castilloa and Funtumia trees respectively for the different plots, during the past five years, is shown graphically in diagram IX.

NOTES.

At the meeting of the Board of Agriculture on June 21, 1916, His Excellency the Governor, Sir John R. Chancellor, R.E., D.S.O., K.C.M.G., took the chair for the first time as President. The Director of Agriculture (Vice-President), supported by the Hon. Sir Norman Lamont, Bt. welcomed His Excellency on behalf of the members.

His Excellency the Governor distributed prizes to the successful competitors in the Cacao Prize Competition in the Brasso Piparo District, (*See* Report in *Bulletin XV.*—96-100) at the Riversdale School, Williamsville on July 8.

A preliminary report of the results of tests of the cane varieties, 17 months old, grown in Nursery No. 2, at St. Augustine Experiment Station was presented to the Board of Agriculture, on June 21, by Mr. J. de Verteuil, Superintendent of Field Experiments. The results of the canes, in order of sucrose per acre, were B. 6308, 4·04 tons; H. (Hawaiian) 227, 3·98; B. 3922, 3·81; B. 6835, 3·68; B. 7169, 3·51; B. 6450, 3·43; B. 6388, 3·41; B. 4934, 3·29; B. 3390, 3·19; B. 8600 (B.N.H. 02 (1), 3·11; H. 146, 3·06; Bourbon 2·84; B. 4578, 2·84; H. 27, 2·73; B. 8660, (B.W.H 02 (5), 1·85.

The complete report of these and other experimental work on canes will be published later.

A swarm of locusts from Venezuela alighted at Patos—a small island dependency of this Colony lying close to the mainland, on June 10. Finding little to eat owing to the parched condition of the vegetation, they took to flight again and by a strong easterly wind were driven back to Venezuela.

A few locusts have since appeared on the south-eastern portion of Trinidad which is also adjacent to Venezuela.

Mr. Urich, the Entomologist, at once visited both localities and prompt measures were taken for coping with the pests.

METEOROLOGY.

RAINFALL RETURN FOR MARCH, APRIL AND MAY, 1916.

STATIONS.	Mar., 1916.	Mar., 1915.	April, 1916.	April, 1915.	May, 1916.	May, 1915.	Jan. to May, 1916.	Jan. to May, 1915.
North West District.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
St. Clair—Royal Botanic Gardens ...	1·57	...	1·91	2·63	0·94	2·76	11·06	8·15
Port-of-Spain—Colonial Hospital ...	0·67	...	0·51	1.46	0·86	2·54	5·42	5·62
,, Royal Gaol ...	1·02	...	1·10	1·97	1·03	3·44	7·64	7·84
,, Constabulary Head-quarters ...	0·38	...	0·89	2·25	0·95	4·92	5·99	8·27
St. Ann's—Reservoir	3·35	...	2·21	2·23	0·77	3·07	12·30	9·48
Maraval—Reservoir	3·57	...	2·05	3·51	1.73	4·03	16·98	10·71
,, Constabulary Station ...	2·98	...	2·79	5·15	1·30	4·55	16·52	12·16
Diego Martin ,, ,, ...	4·28	...	4·10	4·35	1.42	6·56	18·95	13·83
,, ,, Waterworks ...	4·38	0·12	3·43	4·36	1·28	5·72	18·23	13·23
,, ,, River Estate ...	4·52	0·04	3·26	4·34	1·32	6·01	18·09	12·27
Fort George Signal Station ...	1·78	...	2·27	1·93	0·88	3·24	12·14	7·84
North Post ,, ...	3·40	..	2·11	3·11	1·67	5·76	14·37	10·32
Carenage Constabulary Station ...	2·84	...	3·02	2·38	0·97	6·64	15·99	11·54
Carrera Island Convict Depôt ...	1·50	0·02	0·78	1·11	1·15	4·63	9·15	6·46
Chacachacare Light House ...	2·27	0·06	0·53	3·03	1·13	3·58	8·99	8·89
Santa Cruz—Maracas District.								
Santa Cruz Constabulary Station ...	2·50	...	2·39	3·83	2·41	5·23	16·62	11·66
St. Joseph, Government Farm ...	3·14	...	1·63	3·60	1·39	5·08	12·03	11·41
St. Joseph Constabulary Station ...	2·15	...	1·41	3·85	1·11	2·91	8·58	9·18
Tunapuna, St. Augustine Estate ...	1·76	...	1·39	5·66	0·97	4·10	9·18	12·33
Maracas—Government School ...	2·04	...	2·17	3·44	2·19	3·69	15·74	10·08
,, Ortinola Estate ...	2·00	0·14	2·21	3·73	2·05	3·18	16·45	10·66
Caura, Wardour Estate	1·72	0·09	3·17	2·83	1·97	2·80	12·71	7·97
West Central District.								
Caroni, Frederick Estate	1·77	0·02	1·15	8·12	2·42	4·03	10·87	15·14
Chaguanas, Constabulary Station ...	0·50	0·25	0·89	3·11	0·85	5·34	7·35	11·70
Chaguanas, Woodford Lodge Estate ...	0·67	0·15	0·74	3·02	1·06	5·38	7·67	11·75
Carapichaima, Waterloo Estate ...	0·85	0·03	0·48	2·20	1·10	4·27	8·32	10·04
,, Friendship Hall Estate...	...	...	0·59	2·35	0·76	4·66	5·85	12·01

RAINFALL RETURN FOR MARCH, APRIL AND MAY, 1916.—CONTD.

STATIONS.	Mar., 1916.	Mar., 1915.	April, 1916.	April, 1915.	May, 1916.	May, 1915.	Jan. to May, 1916.	Jan. to May, 1915.
West Central District.—Contd.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
Couva, Exchange Estate ...	0·43	...	1·15	2·58	1·22	3·09	6·95	11·29
,, Brechin Castle ,, ...	1·21	...	1·14	1·95	1·69	4·22	10·08	11·06
,, Perseverance ,, ...	0·76	0·09	0·95	2·01	1·22	3·30	7·10	7·69
,, Camden ,, ...	0·83	0·10	0·92	2·31	1·14	3·54	8·80	10·43
,, Milton ,, ...	0·84	0·22	1·15	2·11	1·91	3·97	11·09	12·39
,, Spring ,, ...	0·97	0·11	1·02	1·72	1·70	5·50	11·83	12·87
,, Constabulary Station ...	0·93	0·06	1·74	2·06	1·67	2·30	10·95	9·82
,, Esperanza Estate, Savonetta ...	1·05	0·05	1·42	2·21	1·22	4·16	10·32	12·08
Montserrat District.								
Montserrat, Constabulary Station ...	0·62	0·16	1·11	2·42	2·10	5·26	10·43	13·40
Brasso, La Vega Estate	1·52	0·15	1·82	2·85	2·37	7·54	16·30	17·28
Santa Clara Estate	1·99	...	1·81	...	3·20	...	16·71	...
Arima District.								
Arima, Warden's Office	0·78	...	1·36	3·05	2·66	5·85	9·65	11·02
Arima, Torrecilla Estate	2·74	0·15	2·89	4·21	4·08	7·08	16·48	15·22
Arima, Verdant Vale Estate ...	3·46	0·02	3·10	2·18	4·57	5·57	20·16	12·75
San Rafael, Constabulary Station ...	1·52	0·33	2·72	4·49	3·36	10·00	19·07	20·63
Guanapo, Talparo Estate	1·69	0·02	2 73	3·30	2·62	10·18	17·03	19·78
Guanapo, San José Estate... ...	2·10	0·24	3·53	3·01	2·94	10·95	20·14	22·80
Tamana, Santa Marta Estate ...	2·70	0·40	3·59	3·55	4·37	10·04	24·73	23·28
,, La Corona Estate... ...	3·60	...	4·52	...	4·70	...	27·13	...
San Fernando & Princes Town District.								
Claxton's Bay, Forres Park Estate ...	1·24	0·02	0·88	3·09	0·86	3·75	10·13	11·70
Pointe-à-Pierre, Bonne Aventure Est...	1·01	0·24	1·90	2·23	1·59	4·54	10·96	13·64
,, ,, Concord Estate ..	1·33	0·45	2·08	2·66	1·89	5·19	12·57	16·09
,, ,, Plein Palais Estate ...	1·05	...	2·04	1·56	0·80	3·39	10·24	10·12
Naparima, Picton Estate	0·84	...	2·05	1·30	1·05	5·00	11·02	13·87
,, Usine Ste. Madeleine Est....	0·94	0·36	1·31	1·55	1·53	5·31	11·58	13·83
,, La Fortunée Estate ...	1·03	...	2·57	2·56	1·00	4·34	12·40	12·27
,, Lewisville ...	0·89	0·06	1·80	2·15	2·06	5·50	13·86	15·91

RAINFALL RETURN FOR MARCH, APRIL AND MAY, 1916.—CONTINUED.

STATIONS.	March, 1916.	March, 1915.	April, 1916.	April, 1915.	May, 1916.	May, 1915.	January to May, 1916.	January to May, 1915.
San F'do & Princes Town Dist.—Contd.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
Naparima, Tarouba Estate... ...	0·20	...	...	1·43	1·29	2·14	6·01	13·23
,, Union Hall Estate ...	0·81	...	2·16	1·75	1·97	4·16	12·49	10·11
,, Palmiste ,, ...	0·82	0·07	2·64	2·88	1·16	4·77	13·09	13·31
,, Hermitage ,, ...	0·65	0·10	2·44	2·00	1·00	4·94	10·43	12·65
Princes Town Craignish Estate ...	0·77	0·22	3·37	2·91	0·57	5·73	12·76	15·90
,, Cedar Hill Estate ...	0·69	...	1·46	1·80	1·20	5·34	10·95	13·92
,, Williamsville Estate ...	0·83	...	2·06	1·41	2·05	5·00	17·23	13·75
,, Esmeralda Estate ...	1·20	0·13	1·70	1·81	2·56	5·95	14·79	15·18
,, New Grant Estate ...	1·54	0·19	2·50	6·89	1·73	7·42	13·68	24·27
,, Constabulary Station ...	0·85	0·17	3·04	1·96	0·37	4·41	11·31	12·58
,, Hindustan Estate ...	1·92	0·12	3·91	4·39	1·50	7·20	16·18	18·79
,, La Retraite Estate ...	1·95	0·27	3·63	5·23	3·94	10·17	23·78	26·35
,, Malgretoute ,, ...	0·84	0·13	2·56	2·25	1·18	6·28	14·57	15·62
Sav. Grande, Friendship & Ben Lomond Estates	...	0·11	2·51	2·23	1·16	5·19	12·51	14·40
Poole, El Rosario Estate	2·89	0·11	2·84	3·09	3·25	11·63	22·75	24·18
Petit Morne Estate	0·26	..	0·94	...	1·24	..	9·52	...
South-West District.								
Oropuche, Constabulary Station ...	1·99	...	2·72	3·20	1·45	4·93	12·93	16·76
,, Pluck Estate	0·64	0·09	4·50	1·92	1·11	5·33	15·08	14·61
Siparia, Constabulary Station ...	1·36	0·45	3·96	6·56	0·83	5·52	13·16	22·40
,, Alta Gracia Estate ...	1·26	0·39	4·16	4·85	1·06	4·10	16·03	16·32
Guapo, Adventure Estate ...	2·25	0·08	4·25	2·60	1·13	3·98	15·37	11·60
Point Fortin—Constabulary Station ...	3·50	0·19	5·05	3·60	1·11	4·72	20·12	15·02
Erin, La Ressource Estate	1·10	...	2·85	1·39	1·24	7·27	9·41	16·48
,, La Union Estate	1·56	..	1·54	...	1·22	...	13·84	...
,, Industry Estate	2·29	0·08	1·12	2·91	1·63	5·48	12·78	13·87
Cedros, La Retraite Estate ...	7·58	0·05	5·17	3·90	3·17	5·88	28·74	16·09
,, Constabulary Station ...	4·20	0·06	5·04	1·41	1·16	7·06	19·25	13·58
,, Beaulieu Estate	3·32	0·02	3·29	1·83	1·48	5·98	18·45	...
,, Perseverance Estate ...	3·75	...	3·95	1·08	1·57	7·19	18·81	13·45

RAINFALL RETURN FOR MARCH, APRIL AND MAY, 1916.—CONTINUED.

STATIONS.	March, 1916.	March, 1915.	April, 1916.	April, 1915.	May, 1916.	May, 1915.	Jan. to May, 1916.	Jan. to May, 1915.
South-West District.—(Contd.)	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
Cedros, Ste. Marie Estate	4·45	...	4·79	1·11	1·49	5·89	20·14	12·18
Icacos, Constance Estate ...	2·45	0·10	2·10	1·70	5·01	6·25	17·70	12·55
Irois, Irois Estate	4·51	...	9·57	4·26	1·44	4·51	26·87	17·25
South Coast.								
Moruga, Constabulary Station ...	2·58	0·05	3·65	1·76	1·30	5·08	14·01	11·85
East Coast.								
Matura, La Juanita Estate... ...	3·11	0·19	4·37	5·08	5·13	8·12	23·05	17·45
Manzanilla, Constabulary Station ...	3·79	0·41	2·40	4·68	4·23	10·89	23·15	23·31
Sangre Grande, San Hilario Estate ...	4·46	...	3·37	...	4·69	...	22·63	...
,, New Lands Estate ...	2·89	0·16	3·85	3·54	3·68	12·44	21·36	25·67
,, Evasdale Estate ..	4·10	0·29	4·14	5·61	4·13	8·90	26·28	22·39
,, Grosvenor Estate ...	4·14	0·36	3·79	7·23	4·90	10·01	26·61	24·75
Mayaro, Constabulary Station ...	1·65	0·19	2·67	1·97	2·83	7·39	17·90	16·06
North Coast.								
Blanchisseuse, Constabulary Station ...	4·02	0·08	2·24	1·29	2·66	7·61	20·66	13·70
Grande Rivière, Mon Plaisir Estate ...	6·84	0·35	3·54	4·30	5·65	7·04	30·12	17·14
Toco, Aragua House	4·04	0·82	2·59	4·31	2·80	4·83	19·80	16·00
,, Constabulary Station ...	3·17	0·51	2·60	5·03	2·77	5·08	17·39	14·19
Point Galera, Light House ...	2·43	0·03	2·18	3·24	0·93	4·03	11·05	9·11
Tobago.								
Tobago, Hermitage Estate ...	2·99	0·35	2·94	8·01	3·77	5·34	21·86	18·57
,, Riversdale ,, ...	1·94	0·07	2·01	2·98	3·77	4·65	13·72	12·83
,, King's Bay ,, ...	2·59	0·14	2·83	7·26	3·88	7·38	20·85	20·43
,, Roxburgh ,, ...	2·81	0·18	3·75	6·45	5·45	7·99	27·72	22·43
,, Luré Estate ,, ...	3·11	0·10	2·05	6·05	4·31	5·67	23·80	19·91
,, Botanic Station	1·35	0·13	1·63	5·48	3·46	5·14	15·85	15·87
,, Government Farm ...	1·08	0·05	1·22	3·08	2·39	2·85	10·77	8·77
,, Lowlands Estate	1·59	0·05	0·85	4·28	1·45	4·46	11·07	12·96
,, Friendship ,, ...	1·91	nil	...	3·91	1·91	5·34	...	13·52
,, Bon Accord ,, ...	1·91	0·04	1·17	3·96	2·30	3·75	12·92	11·27

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RUBBER.

RUBBER SURVEY OF TRINIDAD AND TOBAGO.

AT the April meeting of the Board of Agriculture, a Rubber Committee was appointed, on the motion of the Hon. Sir Norman Lamont, Bart., who said [*] :—

I beg to move the Resolution which stands in my name, viz.: "That it is desirable, in the opinion of the Board, that a Committee be appointed to investigate, and to report upon, the present position and prospects of Rubber Cultivation in the Colony; and to suggest means whereby the most efficient method of tapping, and an uniform manner of preparing rubber, may be introduced upon each plantation as it comes into bearing."

In the *Proceedings of the Agricultural Society* for March of this year (Vol. XVI p. 71) the Secretary of the Society has the following "Note" upon Rubber:—"This industry, which has spelt disappointment and loss to so many, has still the word *nil* against its name in the export list for 1916." Mr. Edgar Tripp's remark is only too true, but I do not want it to *continue* to be true, and that is why I am making this motion to-day.

CAPITAL INVESTED IN RUBBER.

The Rubber Industry here dates principally from the years 1907 to 1910. Rubber may now be found in practically every part of the colony, sometimes in small, sometimes in considerable quantity. Sometimes it has been planted as a pure crop, sometimes in mixed cultivation. Trial has been made of all the three chief kinds of rubber, namely, *Hevea*, *Castilloa*, and *Funtumia*. The Warden's Returns give 2,276 acres as the total area under rubber in Trinidad and Tobago. I have no valid reason for doubting the accuracy of that figure, though I am inclined to think that it may be under-estimated. But even supposing that that low figure is correct, the amount of capital invested in this industry is very considerable. In the East, on the very best managed rubber plantations, £30 per acre is taken as representing the cost of bringing rubber into bearing: £50 per acre is quite an ordinary figure: and even £100 per acre is by no means unknown. Here the cost of labour is far higher, and the growth of the trees has been slower, so to put the cost at £30 per acre, or £68,000 in all, would be quite below the actual figure. On the other hand clean weeding has not been practised, so £100 per acre, or £227,000 would certainly be too high a figure. In any case, a total of £100,000 may be safely taken as well within the amount of money invested in rubber here. This large sum, if it has not been altogether wasted, is at any rate idle, lying stagnant, yielding no return. Yet the price of rubber is now very high indeed. Plantation rubber (Hevea) has been selling at 3s. 7d. per lb., a higher price than has been obtained since the boom of five or six years ago. Plantations in Ceylon and the Federated Malay States, which were started at about the same time as ours, are already producing large crops of rubber, and dividends of ten, twenty, fifty, a hundred, and even two hundred per cent. What, then, is wrong with rubber in Trinidad that it is unable to bring in any return at all?

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[*] From report in *Port-of-Spain Gazette* revised by the author.

Various answers are given to that question. We are told that our climate is bad, our rainfall insufficient, our soil unsuitable, our labour too dear, that we have planted the wrong sort of rubber, and that we have planted on too small a scale. None of these answers is completely satisfying, because none of them is invariably true. Our climate is not unlike that of the Federated Malay States. Our rainfall varies locally from 50 inches to over 100. Soil may be found here of every variety from clay to sand, and from loam to marl.

USE OF A SURVEY.

We want concrete, definite facts; and the only way to get them is by visiting every plantation where rubber is grown on a considerable scale. We must get a real *Rubber Survey*, with accurate facts and figures, showing what has been done in this industry up to now, such as the age of the trees; the number of trees planted per acre; their health, height, and girth; the soil; the average rainfall: the method and cost of cultivation; and finally the method of tapping, if any, and the yield of rubber obtained.

When this knowledge has been obtained, results on estates in various parts of the Colony should be compared with each other, and then again compared with results upon average plantations in the East.

So far as I am aware, the principal planting of rubber may be found on the following estates: those of the Department of Agriculture at St. Clair and St. Augustine; of Mr. E. A. Robinson at Nonpareil; of the Hon. Aucher Warner and Sir Townsend Fenwick at Newlands; of Mr. Monceaux; of Mr. Radcliffe Clarke; of Messrs. Tennant; of Mr. Greig at Cedros; of Messrs. Kleinwort at Carapichaima; also on estates at La Brea and at Poole; at Louis d'Or in Tobago; and on my own estate at Palmiste. There may be other estates which escape me. Members of the Board can doubtless say. But anyhow that is a total of twelve; and I suggest that those twelve, scattered as they are throughout the whole extent of the Colony, are thoroughly representative of its varying conditions. A "survey" of them would be exceedingly interesting. But I want it to be something more. I want it to be useful and practical, Now, three questions are being constantly asked. Optimists ask: "Is it worth while planting more rubber?" Men of moderate temperament ask: "Is it worth while tapping trees already grown?" Pessimists ask: "Ought we not to cut down every rubber tree in the Colony?" I have heard all three questions answered both in the affirmative and in the negative, at divers times and in divers places. The fact is that nobody really knows what the answers are. It may be that those answers should differ in different localities, but the pity is that people should go on waiting for a return on their money, or else throwing good money after bad, because they do not know how to answer these questions, while the answers are obtainable by investigation.

Personally, I am not convinced that even *Castilloa* is a hopeless case. Nobody, of course, would now plant that tree. But where it is already grown, and at the present price of rubber, I believe it pays to tap. Remember *Castilloa* only needs to be tapped three or four times a year, and the cost of tapping is therefore very low. *Hevea* presents quite a different proposition. It needs to be tapped some 220 times in the year. Much more labour is therefore required. The cost of tapping is much greater. But then the yield and the value of the rubber obtained are both much greater too.

METHODS OF TAPPING.

The second point in my Resolution advocates the introduction of the "most efficient method of tapping." Many estates are ready, or almost ready, for tapping. Some definite method should be decided on. During the last seven or eight years immense changes had taken place in the methods of tapping used in the East. Much study has been given to the matter of bark-renewal. The old methods of spiral and herring-bone tapping have been largely abandoned in favour of the single quarter-cut and the basal V. New types of knife, new types of cup, have been introduced. In Trinidad, therefore, we must try to start from the point where the East Indies have now arrived, and so benefit by their experience. If each estate here, as it comes into bearing, tries to train its own labourers to tap, perhaps with a cutlass or a pruning-knife, and without expert advice, not only will such a lack of system involve great loss of time and of money, but irreparable damage will be done to the trees. In this connection I should like to express gratitude to the Department of Agriculture for the educational work which it has done, not only in tapping its own trees, but also in sending out expert tappers to train labourers and overseers on the plantations. It may become expedient, as estates in bearing increase, for the Department to increase the number of its trained tappers and perhaps to institute a *tapper's certificate* to be given to those qualified to teach.

UNIFORM PREPARATION DESIRABLE.

My last point advises the adoption, from the beginning, of "an uniform manner of preparing rubber." If it be true that our whole planted area here only amounts to 2,276 acres, then it is only equal to a very moderate-sized plantation in Ceylon or the Federated Malay States. Thus it should be easy, and it is certainly essential, that the whole of the rubber produced here should be of an uniform pattern, prepared in an uniform way. Only the Department can organise that. But the Committee, whose appointment I am advocating, should inquire as to what is the *best* method of preparing rubber, having regard both to local conditions and manufacturers' requirements. Should it be smoked sheet or crêpe? It is even possible that the crudest and cheapest method of preparation may prove to be the most advisable. Some of the biggest manufacturers like their raw rubber as raw as possible. Many of them put the whole of their raw rubber, of whatever quality, through great crushing mills, so that it all comes out alike. But to be successful any method of preparing raw rubber must cure it thoroughly and must make it thoroughly clean.

APPOINTMENT OF COMMITTEE.

We have seen from the Wardens' Reports how impossible it is to arrive at any useful result if an enquiry is conducted by a different man in each district. It must be conducted by the same man or men throughout all the districts. That is why I wish this Committee to be set up. The expense will be exceedingly small: only for travelling and printing. I am convinced that the result may be the means of saving a very large amount of money that is otherwise likely to be wasted, and so be of great and permanent advantage to the Colony.

The motion was carried unanimously.

His Excellency the Acting President accordingly appointed the following Committee: Hon. Sir Norman Lamont, Chairman; Hon. Aucher Warner, K.C.; Mr. W. G. Freeman, Assistant Director of Agriculture; and Mr. C. S. Rogers, Forest Officer.

CIRCULAR LETTER.

The Committee has prepared the following circular letter and schedule of questions and sent them to the principal estates known to have rubber under cultivation. At the June meeting of the Board His Excellency the President consented, on request, to obtain a return from the Wardens of all properties on which rubber was known to be grown.

Board of Agriculture,
Trindad and Tobago.

Dear Sir,

At a meeting of the Board of Agriculture, on April 19, a Committee was appointed by His Excellency the Acting Governor to enquire into the present position and prospects of the Rubber Industry of this Colony. The Committee is composed of the Hon. Sir Norman Lamont, Bt., Chairman; (Director of the Third Mile Rubber Co., Federated Malay States) the Hon. R. S. A. Warner, K.C.; Mr. W. G. Freeman, (Assistant Director of Agriculture) and Mr. C. S. Rogers, (Forest Officer.)

A large amount of money has been invested here in the planting and cultivation of rubber of various kinds. The time is approaching when the trees should be beginning to yield latex, and the money to yield some return. Yet there is a danger that both trees and money will be allowed to remain idle, unless steps are speedily taken to organize the industry, and to place the collection and preparation of the rubber upon a systematic basis.

In order that this may be done, the first step obviously is to make a Rubber Survey; that is, to ascertain, as exactly as may be, how many acres of the various kinds of rubber have been planted, how much of the area is now ready for tapping, what the cost has been, how the growth compares with that in other parts of the world, and other kindred information.

The Committee has accordingly prepared the enclosed schedule of questions, and will be grateful if you will be so kind as to fill in the replies so

far as applies to your estate, and to return one copy to Mr. Freeman in the enclosed envelope. The other copy you can retain for your own use.

Information regarding different estates, or regarding considerable areas of different rubbers on the same estate, will be more convenient if given on separate schedules, additional copies of which will be sent by Mr. Freeman on application.

The Committee further hopes to visit personally a number of the estates where rubber is growing on a considerable scale, in order to see the cultivation, take measurements and photographs; and to have the benefit of discussing details more fully.

It is hoped that, with the co-operation of the rubber growers of the Colony, the outcome of the work of the Committee will be to place before planters the best available advice as to the treatment of their rubber cultivation generally, with regard to local conditions, and more especially to arrange for practical instruction being given in the best and most profitable methods of tapping trees and preparing rubber for export.

(Sgd.) NORMAN LAMONT,
Chairman, Rubber Committee.

SCHEDULE OF QUESTIONS.

TRINIDAD AND TOBAGO—RUBBER SURVEY.

Name of Estate...

Situation: (*Information desired with reference to the rubber areas of the estate.*)

Locality...

Elevation...

Contour (whether hilly or flat)...

Aspect (including wind exposure)...

Soil (whether heavy or light)...

Rainfall (for each year since rubber planted)...

....

Other Remarks (Presence of rivers, streams, etc.)...

....

PLANTING.

Kind of Rubber or Rubbers...

....

Area or No. of trees...

Source of Plants (*i.e.* Seeds or Stumps: whether local or imported. In latter case, give source)...

....

Method of Planting (at stake or from Nursery)...

Date of Planting...

Height and Girth (average at present)...

....

Planting distance...

Single or mixed cultivation...

Catch Crops (if any): Results...

....

General history of the cultivation (*i.e.* how maintained, weeded, etc.)...

....

Cost of cultivation up to tapping age...

DISEASES AND PESTS.

Notes on Diseases and Pests and also on any other difficulties……………………

…………………………………………………………………………………………

TAPPING.

Age at which tapped……………………………………………………………………

…………………………………………………………………………………………

Girth at which tapped……………………………………………………………………

…………………………………………………………………………………………

Method (Herring-bone, spiral, etc.)………………………………………………………

…………………………………………………………………………………………

Type of knife and cup used………………………………………………………………

…………………………………………………………………………………………

Period (daily ?)……………………………………………………………………………

…………………………………………………………………………………………

Yield :—Yield of Rubber from trees tapped………………………………………………

…………………………………………………………………………………………

Cost…………………………………………………………………………………………

PREPARATION OF RUBBER.

Method………………………………………………………………………………………

…………………………………………………………………………………………

Cost…………………………………………………………………………………………

Sample……………………………………………………………………………………

SHIPPING.

Prices………………………………………………………………………………………

…………………………………………………………………………………………

Reports……………………………………………………………………………………

…………………………………………………………………………………………

Net proceeds per lb…………………………………………………………………………

NOTES ON THE TAPPING OF PARA RUBBER,

By W. G. Freeman,
Assistant Director of Agriculture.

During the last few years the systems of tapping Para Rubber, in the East, have undergone great modification. In the fourth edition of his work on *Hevea brasiliensis or Para Rubber*, published in 1912, H. Wright summarises (pp. 242-9) the methods employed on the chief estates in Ceylon, Malaya, Sumatra, Java, Borneo, South India and Samoa. From an examination of this record it is seen that the system most in vogue then, for trees other than those of only three to five years of age, was the "half herring-bone"; some estates favoured the "full herring-bone"; the "spiral" and "half spiral" systems had been almost discarded.

The "half-herring bone" is the system with one vertical cut from the base of the trunk to about five feet in height, with lateral cuts, inclined upwards, running from one side of it only, and usually reaching one quarter round the trunk; the distance between these side cuts varied from about 12 to 18 inches. In the "full herring bone" the difference was that inclined cuts were made on both sides of the vertical channel, and usually extended half way round the tree.

For young trees, three to five years old the basal Y or basal V was the chief system *i.e.* practically a double herring-bone but with only one pair of lateral inclined cuts, and naturally reaching only a short distance above the base of the tree.

At the present time however the herring-bone systems have largely disappeared. It has been found that equally good returns are obtained from fewer cuts, with consequent saving in the amount of bark which is cut away, and in the demand on the tree for renewal of bark. In other words the fewer the number of cuts the longer will the bark on the tree last for tapping purposes.

Many estates now make only one inclined cut extending around one quarter of the tree. This is practically one half only of the basal Y or basal V already referred to. On other estates two cuts on a quarter of the tree, are made, one above the other.

It has also been found advisable not to cut away steadily the whole of the bark on say one quarter of the tree, and then go on to another quarter and remove the whole of that, but to tap a comparatively short length on one quarter, then proceed to another quarter and so on in rotation.

A very useful digest of modern views on tapping is contained in a report published by "The Third Mile (Federated Malay States) Rubber Co. Ltd." By the courtesy of the Hon. Sir Norman Lamont, Bt., one of the Directors of the Company, extracts from this valuable report are given below for the information of those interested in Para Rubber in the Colony.

There are a large number of trees of tappable age in Trinidad and Tobago, and it is essential that when tapping is begun it should be on sound lines. This is in fact one of the most important objects now before the Rubber Committee of the Board of Agriculture.

In this report the question of tapping every day or on alternate days is also discussed. This is also a very important question, and one which has to be settled in each country with reference to local conditions. In Trinidad labour is more expensive than in the East, and if the same, or approximately the same amount of rubber can be obtained by less frequent tappings, it would mean a considerable reduction in the cost of rubber preparation. Experiments have been conducted at St. Clair since 1912, to determine whether this is possible. Their results, so far obtained, which are given later, indicate that tapping at intervals of about four days will probably be the most profitable in Trinidad at any rate under conditions similar to those at St. Clair. It will be seen however that in the Federated Malay States, daily tapping is recommended, but the difference in conditions, climate, labour, etc., must be borne in mind in drawing conclusions from this section of the report.

The following are extracts from the report of the Third Mile Rubber Company :—

TAPPING SYSTEMS IN THE FEDERATED MALAY STATES.

"The following points brought out in Mr. Sydney Morgan's 2nd and 3rd local reports for 1915, (Malay Research Fund) are of importance in considering this question of the '1-cut' against the '2-cut' system, and 'daily' against 'alternate day' tapping.

'1-cut' against '2-cut.' "In the first experiment spread over 12 months; the relative yields were 1-cut, 100; 2-cut, 128, so that for an increase of 28 per cent. more in yield, twice as much bark was excised.

"He states that it seems to be apparent that the superimposition of a second cut over the basal cut, influences the yield of that cut. The latex forming activities of the tree may be severely taxed and in such circumstances the yield of latex diminishes considerably or ceases. Taking the yield of the 1-cut as a standard (1·0), the average yield per cut in the 2-cut system was 0·64.

"He states:—Apparently the 2-cut system may be preferred to the 1-cut system, if tapped daily, may be continued before it affects the vitality of the tree. This seems possible when one considers the case of old trees which now give higher yields from 1-cut than were formerly obtained from two; but he concludes by expressing the opinion that, as far as one can judge according to present information, *the sanest of existing systems, with the exception of 'one cut on a* quarter' is 'one cut on one-third of the tree daily.'

"He says possibly a heavier system may be safe for the first cycle.

"The second experiment was 1-day, 2-day, and 3-day tapping on two superimposed cuts on a single quarter, but he asks 'how long can this daily system (with 2 cuts) be maintained without affecting the trees?' He comes to the following opinion, formed by observation of the effects of past systems and by close consideration of the modern tendency towards conversation of methods, viz.:—'This much however seems almost certain, that estates commencing daily tapping by one-quarter to one-third the circumference of the tree ought to be able to continue on that system for many years without visible evidence of any ill effects being produced.' He points out however that there are estates, tapped on alternate days for years past, which are able now to show yields of 400 lb. and over per acre per annum.

'Daily' against 'alternate-day' tapping. "Mr. J. A. McGregor in his letter of September 15, 1915, states for 'daily' tapping, 1½ inch is allowed for one month's removal of bark, as against 1 inch on 'alternate day' tapping. In Mr. Morgan's experiment, the following results were shown:—

Average cuts to the inch in each section.	*Amount of bark consumed in each section during the year.*
1. 24 cuts.	1. 14$\frac{1}{8}$ inches.
2. 22 ,,	2. 7$\frac{1}{2}$,,
3. 20 ,,	3. 5$\frac{13}{16}$,,

Results of tapping for long period on same section of bark. "The results of the two experiments (of a third experiment mentioned) in Mr. Morgan's Reports show that after about half the bark, on 15-inch sections had been excised, the yields decrease, and this is to be further investigated. Should it be true, then a possible explanation is given for the marked falling off in yields from trees tapped continuously for a very long period (3 years) on the same section of bark, and it would indicate that it is unwise to mark out trees in such a manner and with such a system that too long a period of continuous tapping is given to one section of bark.

"The caution is given that because the point seems to have been proven in two cases, it does not follow that it applies generally and no definite conclusions can be drawn until further records over a fairly long period are examined. The decrease in the second period was not due to climatic conditions as is shown by the rainfall given:—not only so but the trees wintered during the first period.

"The same result was shown in the second experiment, but in that case the wintering period fell in the second part of the tapping year.

"On the whole the safest system would appear to be for *Young Rubber.* One cut on one quarter at 15 in. first round and 30 in. second round on tree 20 in. girth at 3 ft. from the ground, which would give a cut of about 6 in. at 15 in. from the ground, or if this is considered too light, then first round on one half, second round on third quarter and fourth round on fourth quarter; and then the four quarters above.

"Alternatively:—one cut on one half on alternate days.

"*Old Rubber.* The best system would appear to be one cut on one quarter daily, on such a system that will provide that continuous tapping shall not take place for too long on one section of bark, the maximum being about 15 in.

"*For both Young and Old Rubber.* One cut on one-third of the tree daily appears to be fairly safe but if 6 years renewal was not found sufficient later on it might be difficult to change to one quarter system.

RESULTS OBTAINED BY MODERN TAPPING SYSTEMS.

The efficiency of the simple tapping systems described above, is well indicated by data contained in a publication of the Rubber Growers Association (Incorporated) London, entitled *Analysis of Estates Statistical Forms for the Year 1914*, issued in May 1916. Taking the countries from which returns have been dealt with, the following summary is instructive as to the value of the single and two cuts as described above in place of the former more complicated tapping systems.

CEYLON.

The average yield per acre over all the area in tapping was 261·49 lb.; highest yield per acre 388 lb.; lowest 158 lb.

The highest yield 388 lb. was obtained from 371 acres, 9 to 10 years old, with alternate daily tapping, two cuts on one quarter of the tree. The second highest yield, 384 lb., was from 226 acres with alternate daily tapping, two cuts on one third the tree, and the third highest, 378 lb. was from 603 acres, daily tapping, one cut on one quarter of the tree.

SOUTHERN INDIA.

Average yield per acre, 184·21 lb., highest 269 lb.; and lowest 82 lb.

The highest yield 269, was from 719 acres about nine years old, with alternate and daily tapping, one cut on one third of the tree. The second highest yield, 253 lb. was from 733 acres, daily tapping, mostly one cut on one third the tree, and third highest 240 lb. from 209 acres daily and alternate tapping mixed, part two cuts on one third, and part one cut on one half.

JOHORE (MALAY PENINSULA.)

Average yield per acre 337·60 lb., highest 468 lb., lowest 251 lb. Highest yield 468 lb. from 1,230 acres, mostly seven to nine years old, by daily tapping of a single V on half the tree.

The second highest 402 lb. from 1,342 acres, with daily tapping on basal V and single cut on quarter the tree.

The third highest yield, 311 lb. per acre, from 2,324 acres daily tapping, single V on half the tree.

NEGRI SEMBILAN, FEDERATED MALAY STATES.

Average yield per acre 365·58 lb. highest 452 lb. and lowest 192 lb.

Highest yield, 452 lb. from 1,040 acres, ranging from about ten to seven years old, with daily tapping on basal V, followed by two cuts on one quarter.

Second highest yield, 445 lb. from 537 acres by alternate daily tapping, three cuts on one quarter. Third highest yield, 439 lb. from 935 acres, by daily tapping and basal V at first followed by two cuts on one quarter.

PERAK, FEDERATED MALAY STATES.

Average yield per acre 300 lb. highest 464 lb., lowest 240 lb.

The highest yield, 464 lb. was from 406 acres, seven years old, with daily tapping, first basal V then two cuts on one quarter. The second highest 452 lb. from 207 acres, with daily tapping, two cuts on a quarter; and the third highest yield 413 lb. from 445 acres, daily tapping, single V.

SELANGOR, FEDERATED MALAY STATES.

Average yield per acre 323·23 lb. highest 516 lb., lowest 194 lb.

Highest 516 lb. from 226 acres, mostly about ten years old, by daily tapping, two cuts on a quarter. Second highest yield 457 lb. from 1,211 acres, mostly alternate daily tapping with two or one V's.

Third highest yield 453 lb. from 573 acres, daily tapping; new trees with basal V and afterwards two cuts on one quarter.

SUMATRA.

Average yield per acre 305·11 lb. highest 413 lb., lowest 219 lb.

Highest 413 lb. from 1,675 acres, nine years and younger, daily tapping, one third spiral, three cuts.

Second highest 400 lb. from 1,415 acres, daily tapping as above, and third highest 399 lb. from 386 acres, daily tapping, one third spiral.

JAVA.

Average yield 239·95 lb. highest 362 lb. lowest 140 lb.

Highest yield obtained from 105 acres, seven years old, daily tapping on one quarter and one third of the tree.

Second highest 330 lb, from 718 acres by daily tapping, three cuts on one quarter. Third highest 271 lb. from 1,353 acres, daily tapping older trees on one sixth, and young trees on one quarter, and young trees on one quarter of the circumference.

YIELD OF RUBBER PER ACRE IN THE EAST.

The same report also contains much other useful information. Of special interest is the average yield per acre over all the area tapped and the average rainfall, which are as follow for 1914 :—

	Average yield per acre.	*Average Rainfall.*
Ceylon ...	261·49 lb. ...	127·94 in.
Southern India ...	184·21 „ ...	149·08 „
Johore ...	337·60 „ ...	77·06 „
Negri Sembilan ...	365·58 „ ...	100·91 „
Perak	300·00 „ ...	151·19 „
Selangor ...	323·23 „ ...	100·35 „
Sumatra ...	305·11 „ ...	85·30 „
Java	239·95 „ ...	102·12 „

The only returns on an estate scale so far available for Para Rubber (Hevea) in Trinidad are those obtained by Mr. A. E. Robinson at Non Pariel Estate, Sangre Grande and published in this *Bulletin* XIV, 1915, 118–9.

He obtained 1,608 lb. of rubber from 1,200 trees from 6 to 9 years old, planted 14 ft. by 14 ft., or 220 to the acre. The yield obtained was thus at the rate of 294 lb. of rubber to the acre. The rainfall at Non Pariel for the year in which this tapping was done was 75 in. but it was very dry weather and the average rainfall on the estate is about 110.

It will be noticed that the yield obtained by Mr. Robinson, namely 294 lb. of rubber to the acre, is well within the range of variation of the average yields of estates in the East as given in the above table.

TRINIDAD EXPERIMENTS ON TAPPING INTERVALS.

In 1912 at the August meeting of the Board of Agriculture I stated that experiments would be undertaken to ascertain the best interval to allow in tapping operations, as explained in the following extract from the *Minutes* of the Board:—

"The Assistant Director said :—Work will also be carried out on Hevea trees to ascertain whether it is not more profitable to allow longer intervals to elapse between successive tappings. If the same or even a somewhat less amount of rubber, could be obtained with half the number of tappings it may be more advantageous than the present method of tapping every other day. The important question with regard to Hevea is lessening the cost of production and every possible means of doing this should be given a thorough trial."

The reason for suggesting this line of work was that in Ceylon it had been found by experiments conducted by the Botanical Department that the total yield of rubber from Hevea trees over a series of years was greater when the interval between successive tappings was increased up to a certain maximum. There was also, by decreasing the number of tappings, a reduction in expense and in the rate at which the bark was removed. Also a longer interval was available for bark renewal, because if by tapping every other day on a system which used up the bark of a quarter of the tree in one year, the same area would be tapped again after four years, it follows that by tapping say half as often the bark would only be used up half as fast, and consequently the same area would not be retapped for eight years. More recent results in Ceylon have not confirmed the earlier work and more frequent tapping is now considered preferable there, so far as regards the amount of rubber obtained.

To start the experiment, trees which had been tapped during 1911 and part of 1912 were selected and divided into three groups of five trees each, the average yield of which was approximately equal. These are designated in the following table Series A, B and C, and it will be noted that their average annual yield of rubber per tree, during 1911 when all were tapped every other day, was 2 lb. 8 oz., 2 lb. 8 oz., and 2 lb. 13 oz. Full particulars regarding these groups of trees and their previous yields, etc., are given in a report by Mr. A. E. Collens, F.C.S., the officer in charge of the experiments in the *Minutes of the Board of Agriculture* for March 1913. The leading idea of the experiment was to take these series of trees, which had given very similar yields during a period when all had been tapped at the same interval, viz., every other day, and to compare their yields over a series of years when they were tapped at different intervals, every other day as before in Series A, every fourth day in Series B, and every sixth day in Series C.

Unfortunately, by a misunderstanding, an alteration was introduced into Series A and C, during the end of 1914, and the early months of 1915. It will not however affect materially the general course of the experiment. It will be seen by comparing the yields per tree in Series A. B and C, for the years 1912 to 1916 (the last being for only six months) that whether tapping was done every second, every fourth or every sixth day there has been very little difference in the amount of rubber obtained. The importance of this is obvious. It means that series C trees are giving practically as much rubber as those of Series A, from one third the number of tappings, *i.e.*, at one third the expense for tapping, and with only one third as much bark cut away. The experiments will be continued along these lines for a further series of years, in order to see how the yields compare when the bark already work is retapped. It is here that greater advantage from the longer interval is anticipated. As it is not improbable that bark which has had a larger interval of rest will yield better than that which has been tapped more recently. In this experiment the trees are all tapped on the half herring-bone system, extending around one quarter of the trunk. This was the favourite system in the East when the experiment was started and so has been continued. Any new experiments would now be carried out with fewer cuts.

The table on the following page compiled from the tapping records kept by Mr. Collens gives the result to June 1916. In addition to the experiment already referred to it contains the results obtained in Series D and E, and from the old parent tree. Series D and E were designed to test whether once a week was a suitable tapping interval. It will be seen however that the yields from every seventh day tapping are very low compared with those from every second day, and apparently this interval is too long. It is proposed in 1917 to reduce the interval in Series E to four days to ascertain what difference this makes, continuing Series D as at present.

The old tree, about 40 years of age, has given a total of 65 lb. 6 oz. in four years, during the greater part of which it has only been tapped once every four or six days. The rainfall during most of the time has been very low.

TAPPING INTERVAL EXPERIMENT AT ST. CLAIR EXPERIMENT STATION.

YIELD OF DRY RUBBER PER TREE.

	Year.	Duration of Tapping.	Interval.	Annual yield per tree.	Rainfall.
Series A. 5 trees.	1911	6 months (VII-XII) ..	2 days ...	2 lb. 8 oz...	53·90
	1912	7 do. (I-III & IX-XII)	2 days ..	2 lb. 5 oz...	49·35
	1913	10 do. (I-IV & VII-XII)	2 ,, ...	3 lb. 3 oz...	39·53
	1914	5 do. (I-II & X-XII)..	I-II 2 days .. X-XII 4 days..	13 oz...	54·12
	1915	12 do.	I-IV 4 ,, .. V-XII 2 ,, ..	3 lb. 13 oz...	56·31
	1916	6 do. (in progress) ...	I-IV 2 ,, ...	1 lb. 7 oz .. (6 months)	21·59 (6 m'ths)
Series B. 5 trees.	1911	6 months (VII-XII) ...	2 days ...	2 lb. 8 oz .	53·90
	1912	7 do. (I-III & IX-XII)	I-III 2 days ... IX-XII 4 days.	2 lb. 3 oz ..	49·35
	1913	11 do. (I-X & XII) ...	4 days ...	3 lb. 2 oz...	39·53
	1914	12 do. (I-XII) ..	4 ,, ...	2 lb. 7 oz...	54·12
	1915	12 do.	4 ,, .	3 lb. 14 oz .	56·31
	1916	6 do. (in progress) ...	4 ,, ...	1 lb. 10 oz... (6 months)	21·59 (6 m'ths)
Series C. 5 trees.	1911	6 months (VII-XII) ...	2 days ...	2 lb. 13 oz..	53·90
	1912	7 do. (I-III & IX-XII)	I-III 2 days.. IX-XII 6 ,, ...	2 lb. 2 oz...	49·35
	1913	12 do. (I-XII) ...	6 days ...	3 lb. 2 oz...	39·53
	1914	8 do. (I-VI & XI-XII)	I-VI 6 days... XI-XII 2 days	2 lb. 6 oz ..	54·12
	1915	12 do.	I-IV 2 days V-XII 6 ,,	3 lb. 10 oz ..	56·31
	1916	6 do. (in progress) ...	6 days ..	1 lb. 4 oz... (6 months)	21·59 (6 m'ths)
Series D.	1915	8 months (V-XII) ..	2 days ...	2 lb. 4 oz ..	56.31
	1916	6 do. (in progress) ..	2 ,, ..	1 lb. 8 oz.. (6 months)	21·59 (6 m'ths)
Series E.	1915	8 months V-XII ..	7 days ...	13 oz...	56·31
	1916	6 do. (in progress) ..	7 ,, ...	9 oz... (6 months)	21·59 (6 m'ths)
Old Tree	1912	7 months	2 days ..	22 lb. 13 oz...	49·35
	1913	10 do.	2 ,, ...	17 lb. ...	39·53
	1914	12 do.	I-X 4 days ... XI-XII 6 days	10 lb. 11 oz...	54·12
	1915	12 do.	6 days ..	10 lb. 0 oz ..	56·31
	1916	6 do. (in progress) ...	6 ,, ...	4 lb. 14 oz... (6 months)	21·59 (6 m'ths)

VII-XII indicate months, *e.g.* July to December.

Two days interval in tapping means tapping on alternate days.

SILK CULTURE.

SILK CULTURE IN TRINIDAD.

Past Work and Suggestions for the Future.

The recent report of the Imperial Institute. London, on samples of silk from Trinidad has been already published (*Bulletin Department of Agriculture*, *XV*. 1916, 67-69). As then promised Mr. F. W. Urich's account of past efforts and his recommendations for future work, together with Mr. P. L. Guppy's records of previous experiments are now given. These were sent to the Imperial Institute and are referred to in the report mentioned above.

In the Imperial Institute report values were quoted for the samples of silk sent and Mr. Urich's suggestions generally endorsed, *i.e.*, that the two most promising varieties were the Mulberry and Eri silk and that work should principally be devoted to these; also that the Eri silk will probably be found the better for a local industry.

Sericiculture for Trinidad.

By F. W. Urich.
Entomologist, Board of Agriculture.

Before any steps are taken to induce the inhabitants to take up sericiculture it is necessary to try some experiments at St. Clair or St. Augustine, or at both places, on a somewhat large scale and for this purpose I make the following suggestions:

1. That arrangements be made with Mr. Glaudon for supplying eggs of Eri and Mulberry silkworms and if possible, that his services be retained to help, as he has acquired great experience.

2. That plots of castor oil and mulberry be planted up at St. Clair and St. Augustine to supply the food.

3. That caterpillars of the Trinidad silk moth (*Attacus hesperus*) be collected and reared at St. Clair, and that a supply of the food plant *Casearia* sp. be planted up.

4. That a fresh supply of eggs be imported from the best sources so as to obviate the danger of inbreeding.

For the carrying out of above, it will be necessary to have funds to provide for the following:—

A rearing house, which may be any roofed structure at St. Clair or St. Augustine suitably screened to prevent the attack of rats or insect parasites. A large supply of trays for rearing; these may be made of wood and cloth or of split bamboo. Baskets for cocoons and moths, and a supply of paper, shredded wood, straw or other clean material for the worms to spin in. Racks for trays and baskets. Emerging cages for *Attacus hesperus*. The labour required would be two boys.

From above experiments enough "seed" (as the eggs are called) would be obtained to start the industry in Trinidad and Tobago.

Small proprietors in the country would be the class most suitable to take up the rearing of silkworms, but it could also be done in towns where there is enough yard space to plant up castor oil or mulberry. In both cases children of 10 to 12 years of age could look after the worms.

In this way it would be necessary to have a central place where cocoons would be purchased from the producers. The question of spinning the silk or of shipping cocoons will have to be settled later, but in this connection I may mention that Eri silk requires less treatment than mulberry. The cocoons of the Eri moth have to be reversed and the pupa skin removed by a simple machine. When this is done, the empty cocoons can be packed tightly and shipped. For mulberry silk, more machinery is required, and the treatment of cocoons is far more complicated. On the whole, Eri silkworms would be better as an introduced insect.

With regard to our wild silk, experiments have to be made to determine its value.

Further information can be obtained from the following publications:—

H. Maxwell Lefroy—"Eri or Castor Silk"—*The Agricultural Journal of India*. IV, 125–33.

Lefroy and Ghosh—"Eri Silk"—*Memoirs Department of Agriculture, India—Entomological*, IV, 1912. 1–130.

H. Maxwell Lefroy—"A possible new industry for the West Indies"—*West India Committee Circular*, 27, 1912, 51.

"The possibilities of Sericiculture in British Colonies and Dependencies with special reference to the rearing of wild and semi-wild silkworms." *Bulletin of the Imperial Institute*, XIII, 1915, 87–110.

NOTES ON SILKWORMS IN TRINIDAD.

HISTORICAL.

As far as I have been able to ascertain several ladies tried many years ago to rear the Mulberry silkworm (*Bombyx mori*) but I have not been able to place my hands on any data. The first authentic record comes from Mr. M. C. Glaudon, a most retiring and enthusiastic worker, who has long kept silkworms as a hobby. Mr. Glaudon imported Eri silkworms in 1868 and was successful in rearing them. The Governor at that time, Sir Arthur Gordon, was so pleased with the results obtained, that on the advice of the late Mr. Sylvester Devenish, he offered Mr. Glaudon a gold medal of the value of £10. This gentleman, however, who was of a practical turn of mind, preferred a grant of land instead of the medal, and the Government gave him 65 acres of land on the banks of the Caroni. Mr. Glaudon's intention was to start sericiculture on a large scale, but tempted by the good prices of sugar at the time, he planted sugar cane instead, and made sugar until 1886, when he came to grief like many others in the severe sugar crisis which took place then. During these years silkworms were abandoned altogether.

In 1893 Mr. P. L. Guppy received about two hundred cocoons of the following moths from England. *Antheraea pernyi* or Chinese Oak Silk worm; *Telea polyphemus* or North American Silkworm; *Callosamia*

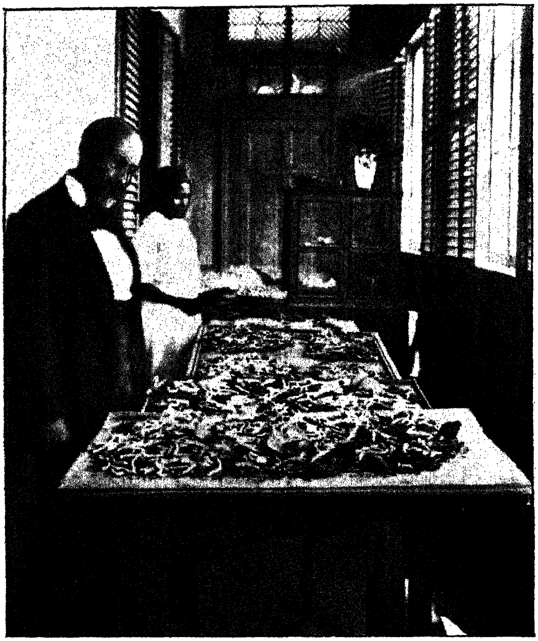

Fig. 1. Trays as used by Mr. Glaudon.

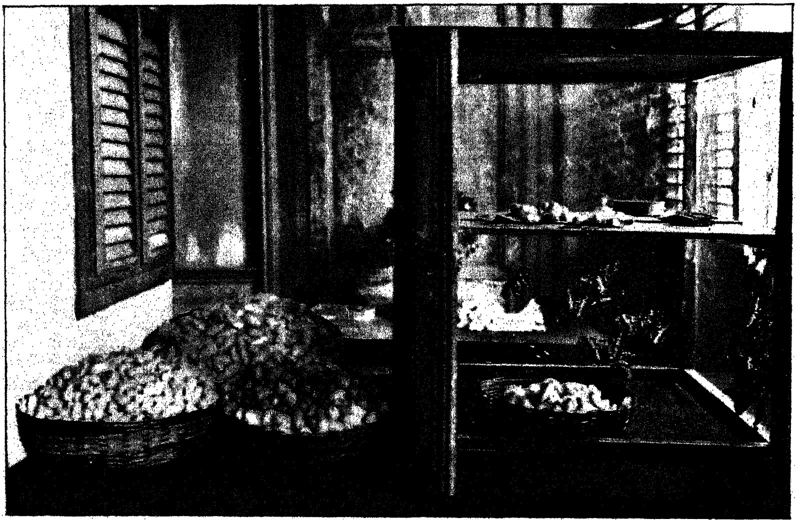

Fig. 2. Baskets of cocoons of Mulberry and Eri silk. Issuing cage containing Eri silk moths and young caterpillars.

REARING OF SILK WORMS IN A PRIVATE HOUSE *promethea* and *Attacus cynthia*. He was successful in rearing *Antheraea pernyi* caterpillars on *Terminalia Catappa* (Almond), and obtained cocoons which were favourably reported upon by Mr. Thomas Wardle, President of the Silk Association of Great Britain and Ireland. No results were obtained from *Telea polyphemus* and *Callosamia promethea*. The *Attacus cynthia* caterpillars fed on the Castor oil plant and on Terminalia and produced cocoons that were not as large as the imported ones. Mr. Guppy's notes are appended (pp. 167-71.)

We next hear of silkworms in 1894, when the late Mr. J. H. Hart, Superintendent of the Royal Botanic Gardens, received a parcel of cocoons of *Attacus cynthia* through Sir Daniel Morris, then Assistant Director of the Royal Gardens, Kew. This experiment was not successful in establishing this silk producer, but it was proved, that the insect can be reared here. Mr. Hart's notes are appended (pp. 166-7.)

In the meantime, Mr. Glaudon, who never forgot his silkworms, made up his mind to try again. In 1907, he imported the best mulberry seeds obtainable from Paris, planted them in his garden at St. Joseph, and when they were established imported eggs of *Bombyx mori*, and since then, he has had this silkworm doing well on a small scale at his house at St. Joseph. So far, the worms have not suffered from any disease. In 1912, Mr. Glaudon made an interesting exhibit at the Agricultural Show, for which he was accorded a "Diploma of Merit." At that time he published a small pamphlet *The Silk Industry*. After the Show in the same year, Mr. Glaudon got into communication with Professor Maxwell Lefroy and Mr. J. H. Watson of Manchester, and imported eggs of the Eri silk moth. With these he has been very successful, and to-day he is in a position to supply Trinidad with eggs. This brings us down to the present day, and thanks to the altruism of Mr. Glaudon, we know that silkworms can be reared successfully here. Mr. Glaudon has never done the rearing of the worms on a large scale.

A reproduction of a photograph of his installation is given.

Mrs. Charles Smith has been very successful in growing mulberry at Santa Cruz and has a thriving plot of about 100 trees planted singly as well as some others in hedges. Cocoons in quantity have not yet been produced, but Mrs. Smith began in the right way and now has enough food for a good number of caterpillars.

IMPORTED SILK PRODUCERS SUITABLE FOR TRINIDAD.

The mulberry grows well in Trinidad, so there is no difficulty about food for the Mulberry silkworm. The caterpillars get on very well here and generation is continuous. The hatching of eggs can be regulated by the use of cold storage, which appears necessary for their well being. Since Mr. Glaudon started in 1907 he has not lost a single worm from disease of any kind. He now has two strains of worms in the pink of condition, one producing yellow silk and another white; he has also obtained a crossing of the yellow and white silk producers.

Eri silkworms get on very well. Generation is continuous, and there is no difficulty about the food plants. Some pupæ remain over for a year or longer, but the percentage of those not issuing at once is small.

So far, this species has not been attacked by any disease. As Eri cocoons require less preparation than those of the Mulberry silkworm, they would appear to be more suitable for Trinidad.

WILD SILK OF TRINIDAD.

The wild silk moth of Trinidad is *Attacus hesperus*. In nature the caterpillars occur only once a year from June to September. According to Mr. Glaudon, they spin their cocoons after 30 days and the moths emerge irregularly from 40 to 50 or 60 days after, sometimes remaining even two years in the cocoon. The caterpillars have irritating bristles, but can be domesticated, and can be treated like the Eri worm. The moths are lively and have to be caged for mating and ovipositing. The silk appears to be good, but so far, no technical report has been made on it. The food plant of the caterpillar is a species of *Cascaria* which is common in many parts of the island. I do not know of any other species of wild silk moth.

INFORMATION DESIRED.

I forward herewith the following samples of cocoons reared by Mr. Glaudon on a small scale at his house at St. Joseph:—

(1) White mulberry.
(2) Yellow „
(3) Eri
(4) Trinidad wild silk (*Attacus hesperus*).

It would be desirable to obtain technical and commercial reports on above.

The question of a market for Trinidad silk could be settled later if anything is done to establish sericiculture here.

Silkworm Experiment (Attacus cynthia).

(From *Bulletin Botanic Department Trinidad*, Vol. i. 1893.)

A parcel of cocoons of this silk-producing insect was received in January last at the Royal Botanic Gardens, having been obtained through the kind offices of D. Morris, Esq., C.M.G., of the Royal Gardens, Kew.

A considerable number of the cocoons was rendered useless through the attack of an ichneumon fly whose eggs had evidently been deposited previous to the time when they left the country of their origin.

Notwithstanding this fact the consignment produced shortly after arrival a considerable number of healthy and well developed imagos of both sexes. From these in due season a number of larvæ were raised.

For the food castor oil leaves were first tried, but it was found that the grubs absolutely refused to touch these. The leaves of *Zizyphus Jujuba*, Lam., (the "Dunks" of Barbados) were next tried, and the insects on this material were successfully fed until they reached maturity. The larvæ went into the cocoon stage in about 30 to 35 days after hatching, and have now remained dormant some four months,* but they are expected to develop shortly.

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*Now over six months, but still alive, and may emerge at any time.

From a Report issued by the Institute of Jamaica we learn that a similar consignment, obtained from the same source, was not so successful as ours, as they failed to raise any cocoons, while those raised by us equalled the original number received.

A dozen of the cocoons were presented to H. Caracciolo, Esq., and another dozen to T. B. Potter, Esq., both members of the Field Naturalists' Club, who had expressed a wish to receive a portion of the consignment for trial. I have not received any report from these gentlemen, but I learn that they did meet with much success.

Whether our cocoons will again produce healthy insects is a question we cannot anticipate, but they are to all outward appearance in a healthy state.

Whether the insect is suited to our climate or not is of course not fully proved, but the experiment so far as it goes, proves that we have suitable food, and that they can be reared with greater ease than the "Tusser" worm on account of the greater facility with which the sexes are found to pair in a state of captivity.

J. H. Hart.

October 3, 1893.

Attacus Cynthia.

THE SILKWORM EXPERIMENT.

(From *Bulletin Botanic Department, Trinidad*, Vol i. 1894. 304.)

It will be remembered that in Circular Note No. 2, published in November 1893, I recorded our experience with these insects. These went into the cocoon stage in May and June, 1893, and on the 26th June, 1894, the first imago was produced from the chrysalis, so that it has remained in that stage for fully twelve months. The remaining cocoons are however so few that it is scarcely probable they will emerge in such order as to allow us to carry on the experiment to another season. One thing however has been proved, viz., that the insect can be reared, and properly matured on West Indian food, and that experiments only require to be conducted on a larger scale to prove an unqualified success, so far as the rearing of the insect is concerned.

Notes on four species of Silk-producing Lepidoptera.

Antheraca pernyi or Chinese Oak Silkworm.
Telea polyphemus or North American Silkworm.
Callosamia promethea.
Attacus cynthia or Ailanthus Silkworm.

By P. L. Guppy.

(From *Journal Trinidad Field Naturalists' Club* i. 1893, 250 *et seq.*)

About two hundred cocoons were sent me from London by a friend on February 15, last. I received them by parcels post.

The first to emerge were two pairs of *Antherasa pernyi* or Chinese Oak Silkworm; they appeared February 26, eleven days after receiving them, between February 26 and 28, all had emerged; these were five pairs.

Immediately after emerging, the moths paired, which they will do in any situation; this is a very good point, the difficulty in some other species of silk producers being that they do not pair easily in captivity. On Monday, February 27, viz., the day after emerging, one pair had separated, I suppose during the night, as there were a lot of eggs laid when I looked in the cage soon after 6 a.m. The eggs are light brown, circular and flattened at the top, which is dark brown. By March 1, there were eggs laid by all the females, except an odd one which laid unfertile eggs. Early on March 8, the eggs began to hatch, which they all did within a couple of days. thus taking about ten days to germinate.

It was with the greatest difficulty, and after trying everything I could think of as a substitute for oak, that at last I found that *Terminalia Catappa* would suit them, though they seem doubtful, as some of them rejected it at first, having for many generations fed on the oak. This can be understood, especially as this species is not nearly so polyphagous as many others, and to quote from a *Catalogue raisonne* by Mr. Alfred Wailly to illustrate this :—

" Prenyi larvæ may be reared on plum and apple trees, but they do not thrive well on these as far as my experience goes. One of my correspondents in Illinois, U.S.A., however, wrote me some years ago that he saw his Pernyi larvæ of the second generation leave oak trees of which the foliage had become hard and tough through the great heat and drought to go and feed on hawthorn bushes; others were found in a garden on apple trees, where they had reached an enormous size."

None of the plants mentioned above grow here; I tried the larvæ on allied species of these trees, which they would not touch, so my difficulty in finding a substitute may be imagined. The larvæ are for the first eight or ten days black, covered with bunches of white hair which rise from tubercles; there are two tubercles to every angulated segment except the last which merges into one. On March 18, most of them had moulted and become light green, with a total change of appearance; after other moults they became very fine-looking insects. The head is light brown, dotted with black, the tubercles being tipped with gold; there are lateral rows of spots, one of gold, and below that one of purple, the bunches of hair become clubbed at the tips and the green light emerald, when at rest they assume a sphinx-like attitude.

Telea polyphumus was the next species, which made its appearance within a short time of Pernyi, one appearing early on February 26, two others at midday, and two more on February 28, unfortunately all were males leaving me two cocoons, one of which (a female) appeared on March 9. I cannot account for the lapse of time between the appearance of the males and the female as they were in the same situation. The female deposited a few eggs on March 13, owing to some mishap the ants got into the cage and killed it. Nine of the eggs proved fertile; parthenogenesis or agamic reproduction in this species has been known to take place as Packard's work on the study of insects gives an instance, although, in so few eggs as I possessed, it would be improbable, though in a few instances the climate might favour the budding process. In *Bombyx mori* parthenogenesis has been known to occur several times.

Telea polyphemus is the best wild silkworm of the United States, with a closed cocoon like those of the genus *Antheraea*, of whichit has all the characteristics. The silk of Polyphemus is white, and in quality it fully equals that of *A. pernyi*, the cocoon is generally smaller. It is difficult to obtain the pairing of the moths in captivity, and the best thing to do is to place the cages containing the moths in the open air. Polyphemus is very polyphagus (from Catalogue of A. Wailly).

On March 7 a pair of *Callosamia promethea* emerged. Eggs were laid on the evening of the 8th. A week after another female emerged. They do not seem to pair well in captivity, as the males are extremely lively and flutter about the cages in their attempt to escape, which seems their only object. This last female laid a number of eggs, which, however, are not fertilized, there being no males about at the time. On the 24th another male emerged after the female had died. I hope the other cocoons will hatch together and pair, as it is rather tantallising to have the insects out at odd intervals. None of the pairs emerged as did the Pernyi, together; however, there are other cocoons of this species and they may produce better results. "The cocoon somewhat resembles that of Cynthia, but is smaller and more elongated; the species altogether is smaller." (*Catalogue raisonne*).

Attacus cynthia. On March 8 a single male emerged, and another on the 11th. On the 14th a female emerged, which laid eggs and died without pairing. In order to be successful is getting these moths to pair, the male and female should emerge together, or within a short time of one another. Up to March 31 no others have emerged.

"Cynthia moths generally emerge about the end of June, and the eggs hatch at the ordinary temperature about a fortnight after having been laid.

"In hot climates this species become bivoltine and even polyvoltine." (Wailly).

RESUME OF THE INSECTS THAT HAVE APPEARED UP TO DATE APRIL 2, 1893.

Of Pernyi there were 11 cocoons. All hatched successfully.

Of Polyphemus, seven cocoons. Five males hatched and one female. On opening the remaining cocoon I found the thorax of the chrysalis sunken in, and upon cutting it open was quite hollow with a growth of white fungus.

Attacus cynthia. Two males and one female emerged. Three cocoons produced one large ichneumon a piece, and about three others, small yellow and black ichneumons. *Conura* sp. near *flavicans* Spin., which came out in numbers about the same time as the appearance of the moths.

Callosamia promethea.—About three males and three females appeared. One or two cocoons produced small yellow and black ichneumons.

There remain about 160 cocoons of Cynthia and Promethea.

LECHMERE GUPPY, JNR.

San Fernando,
April 2, 1893.

The above notes were concluded on April 2 and the following additions give an account of my progress since that date; on April 16 about five weeks and four days after hatching, the larvæ of *Antheraea pernyi* started spinning, between the 16th and 26th April the greater number of them had spun cocoons. This operation generally takes four days. The cocoons seemed to be quite equal in every way, if not superior to those sent me, which were reared on the oak; this opinion has since been confirmed by Mr. Thomas Wardle, President of the Silk Association of Great Britain and Ireland, who wrote as follows:—"They seem to be very healthy cocoons, and if you can grow them as good as these you send, I should think you might introduce sericiculture in Trinidad, but I was not aware that they would feed on *Terminalia Catappa*. It is a Chinese oak feeding worm."

"I enclose a cocoon of the Pernyi from China on which is a portion of the oak leaf. The cocoons reel very well. Yours seem much finer and better, and the silk much whiter than the Chinese pernyi (the above was dated July 17). In reply to my letter of August 8, Mr. Wardle writes:—

"The moths have just emerged (last week) from the cocoons you kindly sent, three of them are quite perfect and beautiful, the other three were deformed. It is an interesting experiment to have fed them on *Terminalia Catappa* successfully. There is an enormous quantity of this silk used in France now, coming into Lyons both from China and India, the Indian King being from the Mylitta, the Chinese from Pernyi. Could you set up a little industry of Pernyi gut for fishing lines?" An interesting fact Mr. Wardle writes is that "Madagascar friend has been reeling spider silk direct from the abdomen of the spider very successfully." Mr. Alfred Wailly writes in a letter to me dated July 24:—"Yesterday, or the day before, one male moth pernyi emerged, the other which is a female judging from the size of it, is still in pupa." These were sent to him early in June and the moths emerged on July 23, those sent to Mr. Wardle on May 17 produced moths about August 24. In the first instance, the moths emerged about 7 weeks before mine appeared here, which must point to the fact that the heat of the present summer in England is greater than we have had it here of late.

The silk possesses a rich gloss; in quality, strength, fineness of texture and shade of colour it is all that can be desired, and when it is considered that the larvæ were retarded to a certain extent through my having to experiment with various trees and shrubs to ascertain what they would feed on, during which time they went without a supply of food, my progress since has been very satisfactory. These larvæ seem to have no particular time for spinning; cocoons were started at all times of the day. Two leaves are made use of between which the cocoon is formed, in many instances, simply a leaf folded cylindrically; a few were formed against the sides of the cage in any convenient corner. The weight of four picked cocoons in an ounce.

On September 7, 1893, rather less than five months after the commencement of the spinning, the first moth emerged, a male, and on the 8th a female. They paired in the evening of the same day, and on the 9th and 10th about eighty eggs were laid. I am expecting the rest of the moths to emerge in a day or two.

On April 13 a male and female of *Attacus cynthia* emerged but did not pair until the 15th, between that date and April 20 many moths emerged and paired successfully, a great number of eggs being obtained. On April 25 the first batch of eggs hatched, thus taking about ten days to germinate. On April 30 they moulted for the first time, they were fed on the *Ricinus communis*, on which they throve very well; some of them were also fed on *Terminalia Catappa*, and I have no doubt that if I had had a greater supply of this almond to feed them on they would have produced much better results than those fed on the castor oil plant, and as I had Pernyi and Cynthia worms to attend to at the same time I devoted much more time and care to the former, numbers of the latter were carried off by wasps through having too large a mesh of perforated zinc. At first I was unable to account for the disappearance of the worms, but by keeping watch I perceived a few small wasps at work, of course they could only carry off the very smallest worms; this was put a stop to by using mosquito netting. From experiments made, feeding the worms on plants protected by muslin sleeves, very good results were obtained, the heavy rains not having any bad effects. The leaves of the castor oil plant afford a very safe retreat, the large size of the leaves protect the larvæ from the rush of water.

On May 23 and up to May 30 the greater number spun cocoons, these are not, however, as large as the imported ones. I have been informed that when they are acclimatized much better results may be obtained. It is my intention to raise as many as possible of the second generation on *Terminalia Catappa* which produce such splendid results with *Antheræa pernyi*. No moths have appeared up to September 15, 1893.

Callosamia promethea:—Up to April 4 on fertile ova were obtained, and as stated in my former notes, they did not pair easily since then, I have obtained much better results. On April 4 there were several moths out, and pairings took place up to April 23. Numbers of eggs were laid up to April 15, the larvæ hatched in numbers, and though some of them fed on *Ricinus communis*, they did not thrive well, and died off at all stages; a few at the spinning period.

LECHMERE GUPPY, JNR.

San Fernando,
September 15, 1893.

PLANT DISEASES AND PESTS.

NOTES ON THE SOUTH AMERICAN MIGRATORY LOCUSTS (Schistocerca paranensis),

By F. W. URICH,
Entomologist, Board of Agriculture.

In the February number of this *Bulletin* XV 1916, 15-16 information was given on the movements of locusts in Venezuela up to November 26, 1915, when large numbers of hoppers appeared near Guiria and other localities of the Gulf States of Venezuela.

This brood, the third since May 1915, appears to have oviposited in due course, and we did not receive any reports of locusts until May, when Mr. Robert Henderson forwarded an extract from *El Luchador* of Ciudad Bolivar, in which it is mentioned that on May 23 a cloud of these destructive pests passed over that city. On June 13, Mr. Henderson sent us a box of locusts, and in the accompanying letter said that locusts were then flying over the city of Bolivar from a north-easterly direction. On June 7, Mr. Edward Gransaull was good enough to inform us that flying locusts had put in their appearance at Patao, a locality on the Gulf of Paria opposite Trinidad. Since then and up to the time of writing, large swarms appear to be on the move in Venezuela.

THE SITUATION IN TRINIDAD.

Since November 5, 1915 no locusts reached Trinidad until June 10, 1916, when a large swarm landed on the island of Patos, but not finding the conditions of food good, the vegetation being quite parched, it took to the wing again and was driven back to Venezuela by a strong easterly wind. On July 16 and 18 another swarm landed at Patos and remained there. Most of the insects were killed by means of bran mash. On July 11, the Warden of Cedros reported that some live locusts and many dead ones had arrived at Cap de Ville and Icacos. This time the invasion presented a novel feature and apparently came from a new quarter, the Orinoco. The locusts did not arrive by flying but by clinging to large floating masses of rushes that grow in the Orinoco and had been detached by the strong current of the river which appears to have been in flood at the time. On July 15 a few isolated locusts landed at Chacachacare Lighthouse. On July 24 Patos was again invaded by a large swarm, a few individuals of which found their way to Chacachacare. As on former occasions, bran mash was used at Patos, and most of the insects killed.

PREVIOUS PAPERS.

"Locusts": *Bulletin Department Agriculture*, XIV, 1915, 64. Note on occurrence in Venezuela.

"Locusts or Grasshoppers": By F. W. Urich, *Bulletin Department of Agriculture* XIV, 1915, 120-8. General article with map of the Gulf of Paria.

"Report on Locusts in Venezuela": By W. G. Freeman, *Bulletin Department of Agriculture* XIV, 1915, 191–4. Report with illustrations of damage done to crops.

"Notes on the South American Migratory Locusts": By F. W. Urich, *Bulletin Department of Agriculture*, XIV, 1915, 194–7. Report on a visit to Guiria.

"Report on the Inoculation of Locusts with Cocobacillus acridiorium": By J. B. Rorer, *Bulletin Department of Agriculture*, XIV, 1915, 197–8.

"The Manurial Value of Locusts": By A. E. Collens, *Bulletin Department of Agriculture*, XIV, 1915, 199.

BOTANICAL.

THE PALMS OF TOBAGO.

By W. E. Broadway.
Horticulturist and Assistant Botanist.

The palms which are now known to occur wild in Tobago number ten (or eleven if we include the exceedingly doubtful *Desmoncus polyacanthus* Mart.) and of these few indeed were known up to 1908 when I was transferred from Trinidad to take charge of the Botanic Station, Tobago. Two as will be seen, are new species.

1.—*Acrocomia aculeata*—Lodd—Gru-gru.

This is common throughout the drier parts of the island, often times dying off as though affected with "bud rot" or some allied fatal disease. The trunk cut into rough planks is used in the building of labourers' kitchens. Trunk single, very prickly, flowers yellow, fragrant.

2.—*Bactris major*—Jacq.

Found in clumps in damp lands, with several prickly stems arising from one common rootstick. Flowers yellow.

3.—*Bactris Sworderiana*—Becc. (n. sp.)—Sampson; Cow Gru-gru.

This new palm commemorates the name of Mr. G. Humphrey Sworder, a Tobago planter who assisted the writer so much with the Tobago orchids.

Stems many, forming clumps. Grows in forest parts of the island where it is known as Sampson and cow Gru-gru. Both stem and leaf are very prickly.

4.—*Desmoncus major*—Crueger—Lattan.

This is the only climbing palm so far seen on the island. Its red bunches of ripe fruit look very pretty as they hang upon the upper, slender stems in which position they are supported by neighbouring shrubs and trees. The mature stems split into lengths are used for making baskets, etc. It is generally distributed throughout Tobago.

The allied *Desmoncus polyacanthus* Mart. reported to occur in Tobago has never been found by me although specially searched for. The record of it as a Tobago palm appeared in the *Kew Bulletin*.

5.—*Euterpe Broadwayæ*—Becc. (n. sp.)

Only found in the moister, cooler parts of the island as at Menna, and again between Roxborough and Parlatuvier. Trunk single or several together. The flowering parts are fluffy in which are subsequently embedded the fruits. When young, it somewhat resembles, in habit, the *Chrysalidocarpus lutescens* but, later, assumes loftier proportions.

Named after the discoverer's daughter, Elsie.

6.—*Euterpe globosa*—Gaertn—One Man.

In the forest at Menna, Caledonia, etc., this splendid, tall, single stem palm is plentiful and there forms a special feature of these cool, mountainous places.

7.—*Geonoma vaga*—Griseb and Wendl.

In Trinidad, where it also occurs and is called Anari, this pretty little palm furnishes strong walking sticks. It is found in Tobago in forest lands intermixed with shrubby and other under growths beneath the shade and protection of larger trees.

8.—*Oreodoxa oleracea* Mart.—CABBAGE PALM.

This well known palm throughout the West Indies, is gregarious in Tobago, in forest lands whence they are gradually disappearing before the necessary clearances of the cocoa planter. So important, locally, are the hard, matured trunks considered that they are cut into lengths and used in the building of houses for labourers.

There is a flowering specimen at Rockley Vale, near the Botanic Station, at Scarborough, which bears erect, stiffish leaves instead of the usual drooping feathery ones. It is possible that it may be a distinct variety and is worthy of investigation. Another cabbage palm grows in quantities together in a hollow on Little Tobago island (where the introduced Birds of Paradise are) which look to me different from either of these two. In any case it would be interesting to know what the Rockley Vale one really is as well as those of Little Tobago island.

9.—*Scheelea insignis*—Karsten—*Maximiliana insignis* Mart.—MACCA.

Trunk single, stout and tall, leaves long, erect; flowers yellow and of a peculiarly strong odour; fruit bunches huge with the individual fruits containing large, hard, indestructable seeds.

Several of these trees grow together upon the hills of the Widow, Les Coteaux, &c.

10.—*Thrinax argentea*—Lodd—THE BROOM PALM.

This palm flourishes in abundance on lands in the neighbourhood of the sea, as for instance, near Louis d'Or (Windward), and also at Lowlands on the drier, hotter end of the island facing Trinidad. On Little Tobago island it occurs by the thousand in all sizes, from tiny seedlings to tall adults; on this island, *Thrinax argentea* and *Anthurium Hookeri*, are the predominant plants.

House brooms are made from the leaves of this palm. The silvery colour of the under leaf surface is very prominent in a high wind. It will be observed, from these notes that Tobago has amply repaid the study of its palm flora inasmuch as it yielded two new members, namely, *Bactris Sworderiana*, Becc. (*n. sp.*) and *Euterpe Broadwayæ*, Becc. (*n. sp.*)

PUTRANJIVA ROXBURGHII.

A New Shade Tree.

We are indebted to Dr. G. H. Masson. F.R.S.E. for seeds of the Euphorbiaceous tree *Putranjiva Roxburghii* Wall. which in Calcutta is very highly esteemed as a shade tree for streets, avenues, etc. Seeds supplied by Dr. H. G. Carter of the Royal Botanic Gardens, Calcutta, and brought over personally by Dr. Masson, have germinated well and it is hoped that in time the introduction will result in the addition of a new ornamental shade tree to the Colony.

As the balance of the introduced seed has been distributed by the Department of Agriculture to other West Indian Botanic Gardens, etc., the following description supplied by Mr. C. S. Rogers, Forest Officer, from Brandis' *Forest Flora of North, West and Central India* will doubtless be of interest. It will be noted that the wood of the tree is of economic value as timber, the leaves as cattle fodder, and that the seeds are not without reputed virtues.

"A middle-sized evergreen tree, with dark-green foliage, branchlets and petioles pubescent. Leaves elliptic-oblong, with unequal-sided base, serrulate, short-petiolate, 3-5 inches long, the upper side glabrous, shining, lateral nerves numerous.

"Male flowers small, yellow, subsessile, numerous, collected in sessile irregularly globose axillary heads; calyx 3-5 cleft, stamens 3, filaments more or less connate. Female flowers pedunculate, axillary, often in twos or threes; calyx 5-6 cleft, segments oblong, obtuse. Ovary 3 celled, pubescent, styled 3 short, dilated into triangular lobed stigmas. Fruit ovoid, smooth, white ⅔ in. long, nut pointed, very hard, rugose, 1 celled, 1 seeded.

"Sub-Himalayan tract, common in places, ascending to 2,500 ft., and extending west to the Chenab, frequent in the Oudh Forest. Bengal Burmah, South India, Ceylon, often cultivated. Generally in low shady, moist, mixed forests, often associated with Eugenia and Ficus glomerata. Fl. March–May, and the fruit ripens in January–June of the ensuing year. Leaves renewed in April. A fine shady tree, which merits extended cultivation. Attains 40–50 ft. with a straight erect trunk, 4–5 at times 9 ft. girth numerous divergent, spreading branches. Bark ½ in. thick, grey, smooth overrucose, with numerous horizontal lines of round light-coloured, specks, inner bark, yellow, fibrous. Wood light-grey, streaked with dark lines and patches, not very hard, even-grained and durable. Weight. 36·6 lb. per cub: ft. (Wallich), probably heavier. Used in places for tools and on turning. The leaves are lopped for cattle-fodder, the nuts are strung up in rosaries and in necklaces for children to keep them in health, hence the name 'life of the child'."

Tropical Plants in Florida.

Messrs. Reasoner Bros. of the Royal Palm Nurseries, Florida, in a recent letter, note that owing to the practical absence of frost for the past five years many introduced tropical trees have made good growth. They have the Flamboyante (*Poinciana regia*) 25 feet in height and with a spread of 35 feet at seven years old, and in full flower. *Jacaranda coerulea* 40 feet in height, but larger trees were killed in 1910 when the frost did such great damage to sugar cane and other crops in Florida and Cuba.

They also state that this summer, mangos and avocados are both bearing enormous crops in Florida.

AGRICULTURAL BANKS.

AGRICULTURAL CREDIT SOCIETIES.

Steps are being taken in the Colony to found Agricultural Credit Societies under the Ordinance passed last year and proclaimed on Empire Day, May 24, 1916. At the request of interested bodies, Mr. W. G. Freeman, Inspector of Agricultural Credit Societies, has addressed meetings at Gasparillo, Princes Town, San Fernando and Diego Martin, also a meeting at the Royal Victoria Institute, Port-of-Spain, at which His Excellency the Governor, President of the Institute, was present.

There has recently been issued a publication containing the "Report of the Commission on Co-operation in India." The following extracts from this report, dealing with the essential principles of Agricultural Co-operative Credit Societies will be of value to those interested in such Societies in this Colony. They explain very clearly exactly what Co-operation means, the advantages it gives and at the same time the obligations it entails:—

AGRICULTURAL CREDIT SOCIETIES IN INDIA.

"A primary agricultural co-operative credit society is formed in its first stage by a number of individuals, not less than ten, who, because they are unable individually to obtain the credit which is necessary for their small agricultural operations either in adequate quantity, or at rates, or on terms of honest dealing which enable them to work at a profit, combine together to obtain this necessary credit on reasonable conditions. To effect this each becomes liable for the debts of the society to the extent of the whole of his assets. If in this combination there is a number of well-to-do persons who have joined, not to obtain credit facilities they already possess, but to assist their poorer friends, it is obvious that the addition they bring to the total of the assets of the individual members provides a substantial security to a creditor for any money lent to the society and used by the poorer members. If, on the other hand, all the members are of the same class, too poor individually to be trusted with any loan at a rate of interest which does not include a very large proportion of insurance to guard against the risk of non-repayment, it is equally obvious that the risk on the loans is in no way diminished from a purely material point of view by the combination. It will not we think be found frequent in practice in India for men of substantial position to join a society to support the credit of their poorer neighbours, and consequently it may be taken that the majority of societies belong to the latter class. It is true that even in that case the total assets of the members, may, and generally do in practice, total up to a nominal saleable value, based on the rates obtained at occasional sales, considerably in excess of the total loans granted. It is, however, probable that in the event of the forced sale of a number or all of these assets, the amount realized would be found to be very much less than that which they had been valued and might in many cases fail to cover the debts of the societies, the more especially if many such sales were taking place simultaneously within a small area. Hence it is clear that the creditors' real security consists not in material assets of the members but in the ability and desire of the members to put the borrowed money to productive uses and to repay the loan out of the profits made thereby.

"Each loan should mean so much earning capacity, so much producing power for the individual borrower. The guarantee consists in the expectation that each member of the society knowing that he stands to lose his all by the default of the others, will exert moral pressure on his co-members to ensure that they use for a proper productive purpose the money which they have borrowed and duly repay it at the appointed time. The security in fact lies in the use of each loan for genuine productive purposes, the honesty and thrift of the members, the watchfulness they exercise over each other, the moral influence which they bring to bear upon dishonest or unthrifty co-members and the feeling of solidarity which is usually awakened by association for a common purpose. These represent the essential elements that the business aspect of co-operation also finds its best security. The societies, as we have said in our Report, must in the first place be *co-operative* and must further be *business-like*. The two qualifications are largely inter-dependent, but for the sake of clearness it will be convenient to deal with them separately as far as possible.

"The society to be fully *co-operative* must fulfil many conditions. The theory underlying co-operation is that weak individuals are enabled to improve their individual productive capacity and consequently their material and moral position, by combining among themselves and bringing into this combination a moral effort and a progressively developing realisation of moral obligation. The movement is essentially a moral one and it is individualistic rather than socialistic. It provides as a substitute for material assets honesty and a sense of moral obligation, and keeps in view the moral rather than the material sanction. Hence the first condition obviously is that every member should have a knowledge of the principles of co-operation, if this co-operation is to be real and not a sham. In the information of a society the first essential is the careful selection as members of honest men, or at any rate, of men who have given satisfactory guarantees of their intention to lead an honest life in future. As regards the dealings of the society, it should lend to its members only, and the loans must in no circumstances be for speculative purposes, which, so far from encouraging thrift and honesty, have exactly the opposite effect. Loans should be given only for productive purposes or for necessaries which, as essential of daily life, can fairly be classed as productive. The borrowers should be required to satisfy their fellows that they are in a position to repay the loans from the income that they will derive from their increased productive capacity, or that by the exercise of thrift they can effect a margin of income over expenditure which will suffice to meet the instalments of their loans as they fall due. When a loan has been given, it is essential that the committee of the society and the other members should exercise a vigilant watch that the money is expended on the purpose for which the loan was granted. If it is improperly applied, it should be at once recalled. It is further advisable to add to the general supervision of individual members, by taking personal sureties in the case of each loan. In the event of any default by the borrower an instant demand should be made on their sureties. In the more general matters of the society's business, there should, of course be a committee of management with a president and a secretary, all of whom, except those who perform purely clerical duties and have no voice in the management should be members of the society and give their services to it gratuitously. At the same time the ultimate authority should never be delegated to the office bearers, but should be retained in the hands of the members, who must continue to take a practical interest in the business of the society. With this object the constitution should be purely republican; each member should have one vote and no more in the general meeting and all business should be transacted with the maximum of publicity within the society. For example, there should be kept in some place open to the inspection of every member, a book containing the amount of the loan to any member, and the names of his sureties, and the amount of the loan still unpaid, and each member should be required to know generally how his account stands: general meetings should be frequently held at which the accounts and affairs of the society are fully discussed and explained. The express object of the society should be the development of thrift among its members, and the hope too that this idea of thrift will spread in the neighbourhood. To effect this object loans must be given only when they are really necessary and desirable. Further the development of thrift and of a proprietory interest in the society should be aided by efforts to build up as soon as possible a strong reserve fund from profits. The society must also be encouraged to obtain as much as possible of its capital from the savings which its teaching and example have brought from among its members and their neighbours. With all these must go the elementary business principles of honesty, punctuality, proper accounts, diligence and payment when due. To ensure all this there must be adequate control from within, increasing vigilance and supervision by the office bearers and a continuous effort by members in learning the principles of co-operation, in meeting frequently, in watching others, in working hard and observing thrift, and in punctual repayment of their own loans as they fall due."

METEOROLOGY.

RAINFALL RETURN FOR JUNE, 1916.

Stations.	June, 1916.	June, 1915.	Jany. to June, 1916.	Jany. to June, 1915.
North-west District.	Ins.	Ins.	Ins.	Ins.
St. Clair—Royal Botanic Gardens	10·30	7·05	21·36	15·20
Port-of-Spain—Colonial Hospital	7·73	5·89	13·15	11·51
,, Royal Gaol	9·41	6·29	17·05	14·13
,, Constabulary Hdqr's.	9·53	4·37	15·52	12·64
St. Ann's—Reservoir	10·16	8·29	22·46	17·77
Maraval— ,,	9·87	9·78	26·85	20·49
,, Constabulary Station	9·50	11·29	26·02	23·45
Diego Martin—Constabulary Station	10·72	10·31	29·67	24·14
,, Waterworks	9·85	6·26	28·08	19·49
,, River estate	10·02	7·59	28·11	19·86
Fort George Signal Station	11·61	8·29	23·75	16·13
North Post ,,	10·81	4·87	25·18	15·19
Carenage Constabulary Station	10·24	10·53	26·23	22·07
Carrera Island Convict Depôt	6·07	4·24	15·22	10·70
Chacachacare Lighthouse	5·54	7·22	14·53	16·08
Santa Cruz—Maracas District.				
Santa Cruz—Constabulary Station	5·69	8·87	23·31	20·53
St. Joseph—Government Farm	8·16	7·27	20·19	18·68
,, Constabulary Station	5·64	4·47	14·22	13·65
Tunapuna—St. Augustine estate	7·38	7·51	16·56	19·84
Maracas—Government School	10·16	6·84	25·90	16·92
,, Ortinola estate	9·47	9·23	25·92	19·89
Caura—Wardour estate	7·80	7·00	20·51	14·97
West Central District.				
Caroni—Frederick estate	9·57	10·61	20·44	25·75
Chaguanas—Constabulary Station	7·72	8·36	15·07	20·10
,, Woodford Lodge estate	7·94	8·62	15·61	20·37
Carapichaima—Waterloo estate	8·72	6·68	17·04	16·72
,, Friendship Hall estate	4·96	7·39	10·81	19·40
Couva—Exchange estate	4·60	6·95	11·55	18·24
,, Brechin Castle estate	6·23	8·86	16·31	19·92
,, Perseverance ,,	6·59	5·51	13·69	15·20
,, Camden ,,	4·99	7·92	13·79	18·35
,, Milton ,,	8·36	10·75	19·45	23·14
,, Spring ,,	6·58	10·10	18·41	22·97
,, Constabulary Station	5·66	7·78	16·61	17·60
,, Esperanza estate, Savonetta	7·16	8·91	17·48	20·99
Montserrat District.				
Montserrat Constabulary Station	9·23	11·43	19·66	24·83
Brasso—La Vega estate	9·13	14·13	25·43	31·41
Santa Clara Estate	9·92	...	26·63	...
Arima District.				
Arima—Warden's Office	10·90	8·68	20·55	19·70
,, Torrecilla estate	8·57	12·82	25·05	28·04
,, Verdant Vale estate	11·60	8·41	31·76	21·16
San Rafael—Constabulary Station	12·76	13·83	31·83	34·46
Guanapo—Talparo estate	8·72	14·62	25·75	34·40
,, San José Estate	12·81	13·40	32·95	36·20
Tamana—Sta. Marta estate	12·32	12·59	37·05	35·87
,, La Corona estate	13·45	...	40·58	...
San Fernando & Princes Town District.				
Claxton's Bay—Forres Park estate	6·40	9·53	16·53	21·23
Pointe-à-Pierre—Bonne Aventure est.	6·50	9·76	17·46	23·40
,, Concord estate	6·60	10·88	19·17	26·97
,, Plein Palais estate	5·94	10·05	16·18	20·17
Naparima—Picton estate	7·00	6·89	18·02	20·76
,, Usine St. Madeleine	7·86	8·21	19·44	22·04
,, La Fortunée estate	5·58	14·86	17·98	17·13

RAINFALL RETURN FOR JUNE, 1916.—CONTD.

Stations.	June, 1916.	June, 1915.	Jany. to June, 1916.	Jany. to June, 1915.
	Ins.	Ins.	Ins.	Ins.
San Fernando and Princes Town District.—(Cont'd.)				
Naparima—Lewisville	8·87	9·35	22·73	25·26
,, Tarouba estate	4·94	4·49	10·95	17·72
,, Union Hall ,,	6·81	6·37	19·30	16·48
,, Palmiste ,,	7·93	8·45	21·02	21·76
,, Hermitage ,,	5·99	6·18	16·42	18·83
Princes Town—Craignish ,,	7·80	8·01	20·56	23·91
,, Cedar Hill estate	...	8·68	...	22·60
,, Williamsville estate	6·76	9·64	23·99	23·39
,, Esmeralda estate	8·65	10·38	23·44	25·56
,, New Grant estate	9·58	8·43	23·26	32·70
,, Constabulary Station	7·00	6·70	18·31	19·28
,, Hindustan estate	9·49	9·55	25·67	28·34
,, La Retraite estate	12·92	12·31	36·70	38·66
,, Malgretoute estate	6·95	9·55	21·52	25·17
Savana Grande—Friendship & Ben Lomond estates	7·27	8·55	19·78	22·95
Poole—El Rosario estate	11·75	15·05	34·50	39·23
Naparima, Petit Morne estate	7·55	...	17·07	...
South-west District.				
Oropuche—Constabulary Station	7·08	5·28	20·01	22·04
,, Pluck estate	7·30	5·40	22·38	20·01
Siparia—Constabulary Station	8·69	8·31	21·85	30·71
,, Alta Gracia estate	9·39	6·51	25·42	22·83
Guapo—Adventure estate	8·00	6·04	23·37	17·64
Point Fortin—Constabulary Station	9·80	6·24	29·92	21·26
Erin—La Ressource estate	4·42	5·67	13·83	22·15
,, La Union estate	4·56	...	18·40	...
,, Industry estate	6·35	5·77	19·13	19·64
Cedros—La Retraite estate	8·38	4·51	37·12	20·60
,, Constabulary Station	5·85	3·74	25·10	17·32
,, Beaulieu estate	6·21	5·94	24·66	13·77
,, Perseverance estate	7·25	4·22	26·06	17·67
,, St. Marie estate	6·71	3·70	26·85	15·88
Icacos—Constance estate	11·89	5·24	29·59	17·79
Irois—Government School	8·25	4·09	35·12	21·34
South Coast.				
Moruga—Constabulary Station	8·61	11·46	22·62	23·31
East Coast.				
Matura—La Juanita estate	8·70	14·73	31·75	32·18
Manzanilla—Constabulary Station	7·74	16·15	30·89	39·46
Sangre Grande—San Hilario estate	6·14	14·95	28·77	14·95
,, New Lands estate	9·69	11·05	31·05	36·72
,, Evasdale estate	8·22	15·47	34·50	37·86
,, Grosvenor estate	8·16	16·13	34·77	40·88
Mayaro—Constabulary Station	7·22	12·88	25·12	28·94
North Coast.				
Blanchisseuse—Constabulary Station	7·28	4·71	27·94	18·41
Grande Rivière—Mon Plaisir estate	9·56	13·73	39·68	30·87
Toco—Aragua House	8·04	11·81	27·84	27·81
,, Constabulary Station	6·17	10·63	23·56	24·82
Point Galera—Light House	6·59	7·70	17·64	16·81
Tobago.				
Tobago—Hermitage estate	9·73	3·44	31·59	22·01
,, Riversdale ,,	7·68	4·93	21·40	17·96
,, King's Bay ,,	6·81	4·63	27·66	25·06
,, Roxburgh	8·15	6·28	35·87	28·71
,, Lure estate	6·28	4·57	30·08	24·48
,, Botanic Station	6·35	4·46	22·20	20·33
,, Government Farm	4·47	3·02	15·24	11·79
,, Lowlands estate	4·76	4·29	15·83	17·25
,, Friendship estate	5·17	4·56	17·05	18·08
,, Bon Accord estate	4·38	3·29	17·30	14·56

AREA OF TRINIDAD AND TOBAGO.

The Government has issued to Heads of Departments a Circular, No. 4427/1915/1786, which is reprinted for general information:—

The following amended Return, showing the areas of the Town of Port-of-Spain, of the Boroughs of San Fernando and Arima, and of the various Wards of the Colony, is forwarded for your information; it is to replace the Return published in the *Royal Gazette* of January 30, 1913.

The Wardens will please note that the acreages stated are those furnished by the Engineer in Charge of Surveys and, in future, their returns must be prepared accordingly.

	Area in Acres.		*Miles.*	*Acres.*
The Town of Port-of-Spain ...	1,358			
The Borough of San Fernando ...	670			
„ Arima ...	588			
The Ward of Arima ...	123,119			
„ Blanchisseuse ...	41,527			
„ Cedros ...	53,719			
„ Couva ...	20,964			
„ Chaguanas ...	54,920			
„ Diego Martin ...	34,393			
„ Manzanilla ...	160,360			
„ Mayaro ...	112,752			
„ Montserrat ...	88,149			
„ Naparima ...	74,195			
„ Oropuche ...	82,253			
„ St. Ann's ...	30,961			
„ Savana Grande ...	179,573			
„ Tacarigua ...	74,137			
„ Toco ...	56,846			
	1,190,484	=	1,860	84
„ Tobago ...	73,213	=	114	253
	1,263,697	=	1,974	337

(Sgd.) S. W. KNAGGS,
Colonial Secretary.

June 6, 1916.

(*Bulletin, Department Agriculture, Trinidad & Tobago*, pp. 149–182. Issued Sep. 4, '16).

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CACAO.

REPORT ON EXPERIMENTS FOR THE YEAR 1914-15.

Manurial and Natural Yield Plots.

BY JOSEPH DE VERTEUIL, F.C.S.,
Superintendent of Field Experiments.

THIS report deals with the fourth year's results of the manurial experiments on cacao, under the control of the Board of Agriculture, and is in continuation of the reports for 1911-12, 1912-13 and 1913-14.[*] It also contains the results of the natural yield plots for the last three years.

The results obtained from the manured series during the period from September 1 1914 to August 31 1915 are given for each estate respectively, under Tables I-VIII, and the average number of pods picked per tree for the three previous periods of twelve months is also recorded for comparison.

The manures were applied broadcast to within three feet of the trunk of each tree, about two feet from the edge of the drains, but no forking was done this year except to the plots to which pen manure was applied. *No lime was applied to plots 9 and 10.* Where basic slag, sulphate of potash, and sulphate of ammonia have been applied to a plot, the sulphates of potash and ammonia were applied two months after the slag.

Throughout this report the age of the trees given is the approximate age during the first year of the experiments, viz., 1911-12. In calculating the results recorded in the various tables, it has been assumed that twelve pods produce a pound of dry cacao; the value of the marketable cacao has been retained at 11 cents (5½d.) per pound.

Weather conditions have not been as favourable, during the period under review, as in the previous twelve months, and it will be observed that on every estate except Esperanza and New Grant there has been a marked decrease in the yield. This is particularly noticeable in the *natural yield* plots Table X.

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[*] *Bulletin, Department of Agriculture,* XIV 1915, 1-16.

The total rainfall for the twelve months from May 1 to April 30 in each year is recorded on the diagrams.

In connection with these experiments, it should be mentioned that no work of any special nature was done to the plots on any of the estates, with the exception of the dynamiting experiment at Santa Marta.* The plots were cultivated in the same manner as the rest of the estate, except in so far as the application of manures is concerned, as it would be undesirable to conduct experiments on lines which are not likely to be adopted by the general planter.

Throughout this report data relating to control plots mean the *average* for the control plots.

The yield of each plot during the four years is shown graphically for each estate respectively, so that the increase or decrease for the various plots from year to year can be seen at a glance. The explanation given at the foot of Diagram I applies also to Diagrams II to VIII.

SANTA MARTA ESTATE—TAMANA.

The artificial manures were applied in May and the pen manure in October 1914; the rainfall from May 1, 1914, to April 30, 1915, was 91·92 inches.

There has been a large decrease in the yield of all the plots compared with the previous year; only plots 5 and 7 show a smaller decrease than the control plots.

Compared with crop 1911–12 plots 1, 2, 5, 6 and 7 have given a larger increase than the control plots. The increase from the control plots is 126 pods, against 191 pods per acre from the average of the manured plots.

With the exception of control plot 4, the field under experiment was treated as stated in last year's report with Dupont's Red Cross dynamite, but as will be seen on a comparison of plots 4 and 8 no increase in yield has so far been obtained from the treatment.

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* *Bulletin, Department of Agriculture*, XIV, 1915, 2.

TABLE I.—MANURIAL EXPERIMENTS.—SANTA MARTA ESTATE.

Trees 20 to 25 years old in 1911.

Plot.	Manures applied per tree *each year from 1911.*	Average number of pods picked per tree.			Yield—Sep. 1, 1914, to Aug. 31, 1915.					
						Per acre of 300 trees.				
		1911–12.	1912–13.	1913–14.	Average No. of pods picked per tree.	No. of pods picked.	Lb. dry cacao.	Value of dry cacao at 11 cents per lb.	Cost of manuring.	Column A less Column B.
		*	*	*	*			(A)	(B)	
								$ c.	$ c.	$ c.
1	2 lb. Basic slag, ½ ,, Sulphate of potash	11·33	17·29	32·04	12·27	3,681	307	33.77	9.38	24.39
2	2 lb. Basic slag ½ ,, Sulph. of potash ½ ,, Sulph. of ammonia	8·04	15·23	25·02	10·67	3,201	267	29.37	14.15	15.22
3	2 lb. Basic slag 1 ,, Nitrate of soda	11·52	11·31	19·48	8·65	2,595	216	23.76	13.68	10.08
4	Control—No manure	5·59	6·83	15·96	5·97	1,791	149	16.39	..	16.39
5	2 lb. Bone meal ½ ,, Sulph. of potash ¼ ,, Sulph. of ammonia	4·32	6·01	15·73	7·86	2,358	196	21.56	16.75	4.81
6	1 lb. Bone meal ¼ ,, Sulph. of potash ¼ ,, Sulph. of ammonia 75 ,, Pen manure	10·91	13·65	32·10	12·10	3,630	302	33.22	34.11	–0.89
7	1 lb. Dissolved bones ½ ,, Sulphate of potash ½ ,, Nitrate of soda	6·31	6·94	17·72	8·23	2,469	206	22.66	12.78	9.88
8	Control—No manure	5·94	5·54	16·15	6·40	1,920	160	17.60	...	17.60
9†	Nil	6·25	4·39	21·69	6·00	1,800	150	16·50	...	16.50
10†	1 lb. Dissolved bones ...	5·16	5·57	16·58	4·21	1,263	105	11.55	4.83	6.72
11	½ lb. Sulphate of potash ½ ,, Sulph. of ammonia	8·07	6·44	23·52	8·49	2,547	212	23.32	9.07	14.25
12	¼ lb. Sulph. of potash ¼ ,, Sulph. of ammonia 75 ,, Pen manure ...	8·16	8·11	27·64	7·95	2,385	199	21.89	29.08	–7.19

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* Dividing the figures in these columns by 2 gives approximately the number of bags (165 lb. dry cacao per 1,000 trees.

† 3 lb. Lime per tree, applied in 1911.

ESPERANZA ESTATE—CALIFORNIA.

The manures were applied in March, 1914; the rainfall from May 1, 1914 to April 30, 1915 was 52·02 inches, it has been low throughout the four years.

All the plots on this estate, with the exception of control plot 13, show a decrease in yield on the previous year, but the decrease from plots 2, 3, 9 and 10 is less than that from the control plots.

Compared with crop 1911–12, plots 1, 2, 5, 11, 12 and 13 have given an increase in yield, whereas the other plots show a decrease. The decrease from the control plots is 478 pods against 89 pods per acre from the average of the manured plots.

TABLE II—MANURIAL EXPERIMENTS—ESPERANZA ESTATE.

Trees 9 to 10 years old in 1911.

Plot.	Manures applied per tree *each year from 1911.*	Average number of pods picked per tree.			Yield—Sep. 1, 1914 to Aug. 31, 1915.					
					Average Number of pods picked per tree.	Per acre of 258 trees.				
		1911–12.	1912–13.	1913–14.		Number of pods picked.	Lb. Dry Cacao.	Value of dry cacao at 11c. per lb.	Cost of manuring.	Col. A less Col. B.
		*	*	*	*			(A) $ c.	(B) $ c.	$ c.
1	2 lb. Basic slag ½ ,, Sulphate of potash	16·18	12·14	18·34	16·58	4,278	356	39.16	8.13	31.03
2	2 lb. Basic slag ½ ,, Sulph. of potash ½ ,, Sulph. of ammonia	15·55	12·12	16·99	16·05	4,141	345	37.95	12.23	25.72
3	2 lb. Basic slag 1 ,, Nitrate of soda	15·49	10·53	14·21	13·52	3,488	291	32.01	11.83	20.18
4	**Control—No manure**	**15·24**	**10·88**	**15·80**	**13·27**	**3,424**	**285**	**31.35**	...	**31.35**
5	2 lb. Bone meal ½ ,, Sulph. of potash ¼ ,, Sulph. of ammonia	14·84	12·39	21·79	17·77	4,585	382	42.02	14.46	27.56
6	1 lb. Bone meal ¼ ,, Sulph. of potash ¼ ,, Sulph. of ammonia 75 ,, Pen manure	16·65	12·65	18·89	14·37	3,707	309	33.99	22.66	11.33
7	1 lb. Dissolved bones ½ ,, Sulph. of potash ½ ,, Nitrate of soda	14·83	10·84	16·66	12·73	3,284	274	30.14	11.05	19.09
8	**Control—No manure**	**14·22**	**6·42**	**12·24**	**11·37**	**2,933**	**244**	**26.84**	..	**26.84**
9†	Nil ...	12·66	5·30	9·86	9·47	2,443	203	22.33	...	22.33
10†	1 lb. Dissolved bones ...	11·44	9·20	11·55	11.25	2,902	242	26.62	4.21	22.41
11	½ lb. Sulph. of potash ½ ,, Sulph. of ammonia	12·03	7·93	16·43	12·11	3,124	260	28.60	7.86	20.74
12	¼ lb. Sulph. of potash ¼ ,, Sulph. of ammonia 75 ,, Pen manure	9·91	6·46	14·86	12·75	3,289	274	30.14	18.33	11.81
13	**Control—No manure**	**11·23**	**6·40**	**11·20**	**11·27**	**2,908**	**242**	**26.62**	...	**26.62**

* *Vide* Table I (foot note).

† 3 lb. Lime per tree, applied in 1911 and every alternate year.

NEW GRANT ESTATE—PRINCES TOWN.

The manures were applied in November, 1914, but (as in previous years), no pen manure could be obtained for plots 6 and 12. The rainfall registered on this estate for the twelve months ending April 30 1915 was 80·91 inches, 15·22 inches more than the highest recorded since the experiments were started.

Plots 1, 2, 3, 6, 8, 9 and 12 have given a further increase in yield on the previous year. It will be observed that plot 8 is a control plot, but the average for the two control plots shows a slight decrease.

Compared with 1911-12, all the plots have given an increased yield. Plots 2, 3, 5, 6, 9 and 10 have given a larger increase than the control plots and the manured plots show an average increase of 3,129 pods against 1,822 pods per acre from the control plots.

TABLE III.—MANURIAL EXPERIMENTS—NEW GRANT ESTATE.

Trees 11 years old in 1911.

Plot.	Manures applied per tree, *each year from 1911.*	Average number of pods picked per tree.			Yield—Sep. 1, 1914 to Aug. 31, 1915.					
		1911–12.	1912–13.	1913–14.	Average No. of pods picked per tree.	Per acre of 300 trees.				
						No. of pods picked.	Lb. dry cacao.	Value of dry cacao at 11 cents per lb.	Cost of manuring.	Col. A. less Col. B.
		*	*	*	*			(A)	(B)	
								$ c.	$ c.	$ c.
1	2 lb. Basic slag ½ ,, Sulphate of potash	20·06	20·40	24·34	28·31	8,493	708	77.88	10.14	67.74
2	2 lb. Basic slag ½ ,, Sulphate of potash ½ ,, Sulph. of ammonia	14·16	18·56	25·65	25·67	7,701	642	70.62	14.91	55.71
3	2 lb. Basic slag 1 ,, Nitrate of soda	17·29	20·57	30·87	31·40	9,420	785	86.35	14.44	71.91
4	**Control—No manure**	**15·88**	**15·60**	**26·50**	**21·20**	**6,360**	**530**	**58.30**	...	**58.30**
5	2 lb. Bone meal ½ ,, Sulphate of potash ¼ ,, Sulph. of ammonia	16·11	19·85	27·99	27·41	8,223	685	75.35	17.51	57.84
6	1 lb. Bone meal ¼ ,, Sulphate of potash ¼ ,, Sulph. of ammonia	18·42	22·30	30·05	32·33	9,699	808	88.88	10.54	78.34
7	1 lb. Dissolved Bones ½ ,, Sulphate of potash ½ ,, Nitrate of soda	20·30	21·52	31·19	28·91	8,673	723	79.53	13.54	65.99
8	**Control—No manure**	**19·06**	**23·33**	**27·15**	**31·89**	**9,567**	**797**	**87.67**	...	**87.67**
9†	Nil	18·16	18·40	26·37	31·58	9,474	789	86.79	...	86.79
10†	1 lb. Dissolved Bones ..	20·38	24·06	33·90	29·46	8,838	736	80.96	5.44	75.52
11	½ lb. Sulphate of potash ½ ,, Sulph. of ammonia	10·34	9·08	17·57	16·79	5,037	420	46.20	9.82	36.38
12	¼ lb. Sulphate of potash ¼ ,, Sulph. of ammonia	16·92	17·59	22·27	24·59	7,377	615	67.65	5.51	62.14

* *Vide* Table I. (foot note). † 3 lb. Lime per tree, applied in 1911 and every alternate year.

SANTA TERESA ESTATE—CUMUTO.

The manures were applied in April 1914, and the rainfall in the district for the twelve months to April 30, 1915, was 81·96 inches.

The mixture applied to plot 9 consisted of 120 lb. bone meal, 48 lb. dissolved bones, 86 lb. nitrate of soda and 24 lb. calcium nitrate.

The yield obtained for the period under review is the lowest since the experiments were started and the manured plots show a larger decrease on crop 1911-12 than the control plots, viz.:—1,342 pods against 987 pods per acre.

TABLE IV.—MANURIAL EXPERIMENTS, SANTA TERESA ESTATE.

Trees 40 to 45 years old in 1911.

Plot.	Manures applied per tree, *each year from 1911.*	Average number of pods picked per tree.			YIELD—SEP. 1, 1914, TO AUG. 31, 1915.					
						Per acre of 300 trees.				
		1911-12.	1912-13.	1913-14.	Average number of pods picked per tree.	No. of pods picked.	Lb. dry cacao.	Value of dry cacao at 11 cents per lb.	Cost of manuring.	Col. A. less Col. B.
		*	*	*	*			(A)	(B)	
								$ c.	$ c.	$ c.
1	2 lb. Basic slag ½ ,, Sulphate of potash	16·25	14·22	32·46	10·81	3,243	270	29.70	9.82	19.88
2	2 lb. Basic slag ½ ,, Sulphate of potash ½ ,, Sulph. of ammonia	19·81	22·33	29·84	12·78	3,834	319	35.09	14.59	20.50
3	**Control—No manure**	**12·19**	**16·30**	**30·40**	**9·37**	**2,811**	**234**	**25.74**	...	**25.74**
4	2 lb. Bone meal 1 ,, Nitrate of soda	18·70	24·89	39·76	13·27	3,981	332	36.52	19.11	17.41
5	2 lb. Bone meal 1 ,, Calcium nitrate	17·19	25·62	35·29	12·86	3,858	321	35.31	19.10	16.21
6	1½ lb. Dissolved bones ½ ,, Sulphate of potash ¼ ,, Sulph. of ammonia	10·57	16·12	27·83	10·64	3,192	266	29.26	13.72	15.54
7	**Control—No manure**	**13·38**	**12·38**	**28·70**	**9·62**	**2,886**	**240**	**26.40**	...	**26.40**
8	1 lb. Bone meal 1 ,, Dissolved bones ¼ ,, Sulphate of potash ½ ,, Nitrate of soda	14·65	15·25	31·75	9·93	2,979	248	27.28	16.32	10.96
9	1⅓ lb. "Mixture" ...	12·35	16·44	30·52	7·92	2,376	198	21.78	9.26	12.52

* *Vide* Table I (foot note.)

PERSEVERANCE ESTATE—TALPARO.

The manures were applied in March 1914, and the rainfall registered on the estate for the twelve months to April 30, 1915 was 72·01 inches.

On this estate also, the yield obtained for the period under review is the lowest on record, but the manured plots show a smaller decrease on crop 1911-12 than the control or *no manure* plots. The decrease from the control plots is 1,935 pods against 1,199 pods per acre from the average of the manured plots

TABLE V.—MANURIAL EXPERIMENTS—PERSEVERANCE ESTATE.

Trees 35 to 40 years old in 1911.

Plot.	Manures applied per tree, *each year from 1911.*	Average number of pods picked per tree.			Yield—Sept. 1, 1914 to Aug. 31, 1915.					
						Per acre of 300 trees.				
		1911-12.	1912-13.	1913-14.	Average number of pods picked per tree.	No. of pods picked.	Lb. dry cacao.	Value of dry cacao at 11 cents per lb.	Cost of manuring.	Col. A less Col. B.
								(A)	(B)	
		*	*	*	*			$ c.	$ c.	$ c.
1	2 lb. Bone meal 1 ,, Nitrate of soda	21·05	25·83	34·76	18·36	5,508	459	50.49	18.70	31.79
2	2 lb. Bone meal 1 ,, Calcium cyanamide	25·80	31·49	39·92	19·91	5,973	498	54.78	18.78	36.00
3	Control—No manure	21·53	29·16	35·11	16·30	4,890	407	44.77	...	44.77
4	2 lb. Basic slag ½ ,, Sulphate of potash	24·65	34·83	32·76	20·86	6,258	521	57.31	9.42	47.89
5	2 lb. Basic slag ½ ,, Sulphate of potash ½ ,, Sulphate of ammonia	26·25	37·96	30·53	22·42	6,726	560	61.60	14.19	47.41
6	1½ lb. Dissolved bones ½ ,, Sulphate of potash ¼ ,, Sulphate of ammonia	26·95	40·51	31·03	24·87	7,461	622	68.42	13.32	55.10
7	Control—No manure	21·37	27·43	26·41	16·83	5,049	421	46.31	...	46·31
8	1 lb. Bone meal 1 ,, Dissolved bones ¼ ,, Sulphate of potash ½ ,, Nitrate of soda	25·45	31·30	28·15	19·75	5,925	494	54.34	15.92	38.42
9	Control—No manure	25·68	30·11	31·55	16·10	4,830	402	44.22	...	44·22

* *Vide* Table I (foot note).

LA COMPENSACION ESTATE—ARIMA.

The artificial manures were applied in April and the pen manure to plots 6 and 12 in May, 1914. The rainfall registered on the estate for the twelve months to April 30th, 1915, was 76·48 inches.

All the plots show a decrease in yield on the previous year, but the decrease from plots 1, 2, 3, 5 and 11 is less than that from the control plots.

Compared with 1911-12, with the exception of plots 6, 7 and 8, there has been an increase in yield. Plots 1, 2, 3, 5, 9, 10 and 11 have given a larger increase than the control plots and the manured plots show an average increase of 531 pods against 52 pods per acre from the control plots.

TABLE VI.—MANURIAL EXPERIMENTS—LA COMPENSACION ESTATE.

Trees over 50 years old in 1911.

Plot.	Manures applied per tree *each year from 1911.*	Average number of pods picked per tree.			Yield—Sept. 1, 1914, to Aug. 31, 1915.					
						Per acre of 300 trees.				
		1911–12.	1912–13.	1913–14.	Average number of pods picked per tree.	No. of pods picked.	Lb. dry cacao.	Value of dry cacao at 11 cents per lb.	Cost of manuring.	Col. A. less Col. B.
		*	*	*	*			(A) $ c.	(B) $ c.	$ c.
1	2 lb. Basic slag ½ ,, Sulphate of potash	15·15	21·48	26·09	17·89	5,367	447	49.17	9.29	39.88
2	2 lb. Basic slag ½ ,, Sulphate of potash ½ ,, Sulphate of ammonia	16·34	24·48	27·91	18·07	5,421	452	49.72	14.06	35.66
3	2 lb. Basic slag 1 ,, Nitrate of soda	16·40	22·29	25·84	17·60	5,280	440	48.40	13.60	34.80
4	**Control—No manure**	**13·84**	**17·62**	**21·24**	**15·12**	**4,536**	**378**	**41.58**	...	**41.58**
5	2 lb. Bone meal ½ ,, Sulphate of potash ¼ ,, Sulphate of ammonia	15·85	21·31	27·85	17·75	5,325	444	48.84	16.66	32.18
6	1 lb. Bone meal ¼ ,, Sulphate of potash ¼ ,, Sulph. of ammonia 75 ,, Pen manure	18·10	22·27	31·01	17·60	5,280	440	48.40	25.06	23.34
7	1 lb. Dissolved bones ½ ,, Sulphate of potash ½ ,, Nitrate of soda	15·64	20·12	37·04	14·57	4,371	364	40.04	12.69	27.35
8	**Control—No manure**	**14·46**	**19·62**	**28·07**	**13·53**	**4,059**	**338**	**37.18**	...	**37.18**
9†	Nil	17·25	14·18	31·51	18·61	5,583	465	51.15	...	51.15
10†	1 lb. Dissolved bones ...	11·26	20·28	31·07	14·49	4,347	362	39.82	4.74	35.08
11	½ lb. Sulphate of potash ½ ,, Sulphate of ammonia	10·04	19·75	24·72	17·00	5,100	425	46.75	8.98	37.77
12	¼ lb. Sulphate of potash ¼ ,, Sulph. of ammonia 75 ,, Pen manure	15·78	19·64	30·55	15·95	4,785	399	43.89	20.03	23.86

* *Vide* Table I (footnote). † 3 lb. Lime per tree, applied in 1911 and every alternate year.

SANTA ISABELLA ESTATE—BRASSO.

The manures were applied in April 1914, but it was only possible to obtain 20 lb. pen manure and 30 lb. mulch per tree for plots 6 and 12 respectively. The cost of manuring these plots is also comparatively high owing to the long distance from which the pen manure and the mulch had to be obtained. The rainfall on an adjoining estate from May 1, 1914 to April 30, 1915, was 70·99 inches.

All the plots show a decrease on the yield of the previous year, but the decrease from plots 1, 2, 3, 5, 6, 7, 9 and 10 is less than that from the control plots.

Compared with 1911–12, there has been an increase in yield from plots 1, 3, 5 and 13. The control plots show a decrease, but the decrease from plots 2, 6, 7 and 12 is less than that from the control plots. Taken together the average of the manured plots shows a decrease of 282 pods against 641 pods per acre from the control plots.

TABLE VII.—MANURIAL EXPERIMENTS—SANTA ISABELLA ESTATE.

Trees 25 to 30 years old in 1911.

Plot.	Manures applied per tree, *each year from 1911.*	Average number of pods picked per tree.			YIELD—SEP. 1, 1914 TO AUG. 31, 1915.					
					Average No. of pods picked per tree.	Per acre of 258 trees.				
		1911–12.	1912–13.	1913–14.		No. of pods picked.	Lb. dry cacao.	Value of dry cacao at 11 cents per lb.	Cost of manuring.	Col. A less Col. B.
		*	*	*	*			(A) $ c.	(B) $ c.	$ c.
1	2 lb. Basic slag ½ ,, Sulphate of potash	28·44	35·00	42·58	33·40	8,617	718	78.98	8.55	70.43
2	2 lb. Basic slag ½ ,, Sulphate of potash ½ ,, Sulph. of ammonia	32·26	39·06	48·46	31·24	8,060	672	73.92	12.88	61.04
3	2 lb. Basic slag 1 ,, Nitrate of soda	30·13	33·21	50·23	36·04	9,298	775	85.25	12.25	73.00
4	**Control—No manure**	**28·50**	**28·92**	**43·97**	**26·36**	**6,801**	**567**	**62.37**	...	**62.37**
5	2 lb. Bone meal ½ ,, Sulphate of potash ¼ ,, Sulph. of ammonia	29·85	41·08	49·01	36·59	9,440	787	86.57	15.12	71.45
6	1 lb. Bone meal ¼ ,, Sulphate of potash ¼ ,, Sulph. of ammonia 20 ,, Pen manure	29·28	32·97	35·48	27·41	7,072	589	64.79	31.90	32.89
7	1 lb. Dissolved bones ½ ,, Sulphate of potash ½ ,, Nitrate of soda	25·07	28·69	38·16	24·75	6,385	532	58.52	11.64	46.88
8	**Control—No manure**	**25·84**	**20·55**	**38·76**	**19·26**	**4,969**	**414**	**45.54**	...	**45.54**
9†	Nil	32·70	26·59	35·73	27·55	7,108	592	65.12	...	65.12
10†	1 lb. Dissolved bones ...	35·97	26·63	44·00	25·73	6,638	553	60.83	4.33	56.50
11	½ lb. Sulphate of potash ½ ,, Sulph. of ammonia	37·58	33·92	51·98	30·03	7,748	646	71.06	8.22	62.84
12	¼ lb. Sulphate of potash ¼ ,, Sulph. of ammonia 30 ,, Mulch ...	36·18	38·02	59·74	35·32	9,112	759	83.49	25.27	58.22
13	**Control—No manure**	**25·53**	**23·78**	**47·89**	**27·84**	**7.183**	**598**	**65.78**	...	**65.78**

* *Vide* Table I (foot note.)

† 3 lb. Lime per tree, applied in 1911 and every alternate year.

SOCONUSCO ESTATE—SANTA CRUZ.

The artificial manures were applied in May, the pen manure to plots 6, 12 and 14 in July and the mulch to plot 13 in August 1914. The rainfall registered in the district for the twelve months ending April 30, 1915 was 62·91 inches.

All the plots show a comparatively large decrease on yield of the previous year and only plots 6 and 7 show a smaller decrease than that from the control plots.

Compared with 1911–12, plot 2 alone has given an increase in yield but the decrease from plots 1, 3, 5, 6 and 7 is less than that from the control plots. The decrease from the control plots is 3,168 pods against 2,650 pods per acre from the manured plots.

TABLE VIII.—MANURIAL EXPERIMENTS—SOCONUSCO ESTATE.

Trees over 50 years old in 1911.

Plot.	Manures applied per tree. *each year from 1911.*	Average number of pods picked per tree.			Yield—Sep. 1, 1914 to Aug. 31, 1915.					
					Average No. of pods picked per tree.	Per acre of 300 trees.				
		1911–12.	1912–13.	1913–14.		No. of pods picked.	Lb. dry cacao.	Value of dry cacao at 11 cents per lb.	Cost of manuring.	Col. A less Col. B.
		*	*	*	*			(A) $ c.	(B) $ c.	$ c.
1	2 lb. Basic slag ½ ,, Sulphate of potash	35·40	35·20	35·57	26·44	7,932	661	72.71	11.18	61.53
2	2 lb. Basic slag ½ ,, Sulphate of potash ½ ,, Sulph. of ammonia	29·66	37·28	40·37	31·30	9,390	782	86.02	15.95	70.07
3	2 lb. Basic slag 1 ,, Nitrate of soda	28·57	32·67	34·03	23·46	7,038	586	64.46	15.49	48.97
4	**Control—No manure**	**28·56**	**30·89**	**29·12**	**25·83**	**7,749**	**646**	**71.06**	...	**71.06**
5	2 lb. Bone meal ½ ,, Sulphate of potash ¼ ,, Sulph. of ammonia	28·77	33·10	32·15	23·60	7,080	590	64.90	18.55	46.35
6	1 lb. Bone meal ¼ ,, Sulphate of potash ¼ ,, Sulph. of ammonia 75 ,, Pen manure	32·53	39·41	36·60	29·95	8,985	749	82.39	31.49	50.90
7	1 lb. Dissolved bones ½ ,, Sulphate of potash ½ ,, Nitrate of soda	28·88	35·37	32·55	27·10	8,130	677	74.47	14.58	59.89
8	**Control—No manure**	**30·81**	**25·83**	**23·15**	**12·42**	**3,726**	**310**	**34.10**	...	**34.10**
9†	Nil	27·84	25·88	27·82	14·68	4,404	367	40.37	...	40.37
10†	1 lb. Dissolved bones ...	34·02	30·56	32·79	20·71	6,213	518	56.98	6.63	50.35
11	½ lb. Sulphate of potash ½ ,, Sulph. of ammonia	38·19	34·12	41·08	23·72	7,116	593	65.23	10.87	54.36
12	¼ lb. Sulphate of potash ¼ ,, Sulph. of ammonia 75 ,, Pen manure	40·27	29·54	33·98	17·47	5,241	437	48.07	26.46	22.61
13	100 lb. Mulch ...	33·32	36·55	36·15	24·31	7,293	608	66.88	20.29	46.59
14	50 lb. Pen manure ...	28·50	28·98	28·35	17·22	5,166	430	47.30	14.88	32.42

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* *Vide* Table I (foot note.)

† 3 lb. Lime per tree, applied in 1911 and every alternate year.

PODS PER POUND OF DRY CACAO.

A record of the figures required for ascertaining the number of pods necessary to produce a pound of dry cacao has again been kept during the year and with those for the three previous years is given below.

TABLE IX.

ESTATE.	TOTAL NUMBER OF PODS PICKED.				LB. DRY CACAO.				NO. OF PODS PER LB. DRY CACAO.			
	1911-12.	1912-13.	1913-14.	1914-15.	1911-12.	1912-13.	1913-14.	1914-15.	1911-12.	1912-13.	1913-14.	1914-15.
Santa Marta ...	10,312	11,901	28,785	10,254	834	1,086	2,283	846	12·36	10·96	12·61	12·12
Esperanza ...	23,668	15,097	23,070	20,115	1,812	1,148	1,833	1,531	13·06	13·15	12·58	13·14
New Grant ...	29,342	25,769	37,429	38,084	2,259	2,068	2,395	2,708	12·99	12·46	15·63	14·06
Perseverance ...	35,826	46,151	45,494	27,419	1,901	3,269	3,512	2,121	18·84	14·12	12·95	12·93
La Compensacion ...	26,184	35,375	49,052	28,609	2,054	3,208	4,277	2,479	12·75	11·03	11·47	11·54
Santa Isabella ...	48,961	51,320	74,052	48,795	4,475	5,088	7,083	4,796	10·94	10·09	10·45	10·17
Soconusco ..	58,337	57,930	58,213	39,811	4,172	3,975	4,120	2,650	13·98	14·57	14·13	15·02
River ...	35,596	46,137	56,294	55,121	2,779	3,839	4,710	4,597	12·81	12·02	11·95	11·99
Brooklyn ...	68,261	80,098	92,141	64,412	5,520	7,363	8,185	5,862	12·37	10·88	11·26	10·99

NATURAL YIELD OF PLOTS.

The results obtained from the *natural yield* plots for the three years to August 31, 1915, are recorded in Table X.

TABLE X.—NATURAL YIELD OF PLOTS.

	AVERAGE NUMBER OF PODS PICKED PER TREE.														AVERAGE NUMBER OF LB. WET CACAO PICKED PER ACRE.	
	LA RETRAITE ESTATE, PRINCES TOWN. Trees 20 to 22 years old in 1912.		LA COMPENSACION ESTATE, ARIMA. Trees over 50 years old in 1912.		EVASDALE ESTATE, CUNAPO. Trees 18 to 19 years old in 1912.		SANTA MARTA ESTATE, TAMANA. Trees 22 to 25 years old in 1912.		SOCONUSCO ESTATE, SANTA CRUZ. Trees over 50 years old in 1912.		PERSEVERANCE ESTATE, TALPARO. Trees 40 to 45 years old in 1912.		EL SALVADOR ESTATE, MONTSERRAT. Trees 35 to 40 years old in 1912.		ROXBURGH ESTATE, TOBAGO. Trees 9 years old in 1912.	
	Average for 2 years, 1912–14.	1914–15.	Average for 2 years, 1912–14.	1914–15.	Average for 2 years, 1912–14.	1914–15.	Average for 2 years, 1912–14.	1914–15.	Average for 2 years, 1912–14.	1914–15.	Average for 2 years, 1912–14.	1914–15.	Average for 2 years, 1912–14.	1914–15.	Average for 2 years, 1912–14.	1914–15.
Plot.	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
1	21·55	12·58	25·62	15·41	37·02	19·94	25·87	17·26	25·04	18·14	32·03	20·13	44·48	38·04	1,824	2,328
2	23·11	16·94	16·55	14·07	34·56	18·88	20·05	17·50	28·36	18·53	37·08	19·66	48·98	40·42	1,299	2,164
3	19·03	18·51	22·21	16·48	28·36	15·28	22·29	17·76	30·48	21·59	37·73	21·85	53·47	39·77	1,163	1,678
4	21·34	16·94	22·34	21·37	28·38	14·48	21·36	19·03	31·61	25·11	27·29	15·32	51·03	41·42	1,244	2.070
5	18·99	15·16	19·51	20·16	31·94	14·34	27·10	21·28	30·22	20·07	37·47	18·06	56·76	40·32	1,294	1,952
6	16·75	12·93	23·14	22·54	24·07	15·21	24·76	19·20	35·38	25·88	32·25	20·40	42·85	33·93	1,273	1,974
7	16·90	11·36	22·49	21·25	25·72	12·77	23·18	17·88	33·74	22·91	39·32	28·31	42·90	33·94	1,260	2,127
8	31·58	15·09	19·23	17·07	26·95	11·58	22·37	18·00	31·83	22·22	48·25	32·82	43·40	41·95	1,413	2,051
9	27·77	12·14	18·69	20·59	25·33	10·65	25·18	14·07	26·65	18·91	41·26	31·37	37·68	36·75	1,616	2,132
10	19·22	7·54	20·49	21·00	27·67	14·16	26·92	20·83	24·29	15·66	46·74	30·58	43·65	37·92	1,205	1,759
11	24·19	8·33	17·55	14·92	28·33	15·18	25·11	21·62	22·16	13·45	43·20	27·57	40·09	34·43	1,206	1,991
12	28·71	14·13	19·54	23·98	27·83	14·45	28·00	14·60	21·70	15·59	26·05	12·54	35·01	33·25	1,103	2,064
13	36·73	15·57	20·41	19·74	27·64	12·52	26·91	14·51	18·94	14·25	29·36	13·74	39·67	34·91	1,500	2,057
14	36·53	15·41	27·70	17·80	23·46	10·99	23·45	12·42	19·80	11·62	24·59	8·69	38·23	33·89	1,717	2,235
15	12·93	8·41	25·00	16·11	24·13	12·50	27·91	15·14	20·65	11·93	19·43	9·23	42·80	34·73	1,891	2,511
16	14·86	8·81	23·73	21·02	20·71	10·69	26·67	17·72	21·63	12·77	25·30	15·80	43·05	32·96	1,955	2,195
17	13·96	5·30	22·41	22·75	18·75	9·74	27·26	15·81	23·95	14·70	28·17	20·99	35·16	29·98	1,951	2,106
18	17·63	12·14	27·74	26·36	24·73	13·64	27·89	19·46	25·93	19·27	21·93	14·41	38·37	32·40	2,122	2,176
19	21·13	8·37	28·58	32·16	23·97	13·06	26·41	19·07	29·74	19·03	14·23	8·84	42·98	35·27	1,834	2,193
20	16·59	9·57	21·37	30·86	24·79	14·02	18·48	9·51	29·85	21·78	16·91	9·60	40·68	34·42	1,828	2,055
21	18·08	12·26	18·35	27·12	27·33	11·06	22·33	10·92	36·93	26·57	29·11	24·57	39·99	36·64	1,368	1,872
22	...	...	...	...	...	...	...	...	25·26	19·51	...	...	...	...	1,645	2,223
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1,668	2,446
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1,353	1,086

From the figures recorded in this table it will be seen that the yield obtained on the different estates does not show any uniform variation compared with the average yield of the two previous years.

1. There has been a decrease in yield from all the plots on the La Retraite, Evasdale, Santa Marta, Soconusco, Perseverance and El Salvador estates.

2. On the La Compensacion estate 13 plots show a decrease, whereas 8 plots have given an increased yield.

3. With the exception of one plot, all the other plots on the Roxburgh estate have given an increased yield compared with that of the two previous years.

The increase or decrease in the crop of each plot compared with the average of the two previous years is shown in Table XI. A minus (-) sign indicates a decrease; the figures without any sign in front indicate increases. The results are stated as pods picked per tree, except for the Roxburgh estate where they are given in pounds wet cacao per acre.

TABLE XI.—NATURAL YIELD OF PLOTS, SHOWING THE INCREASE OR DECREASE OF CROP 1914–15 ON CROPS 1912–14.

Plot.	LA RETRAITE ESTATE.	LA COMPENSACION ESTATE.	EVASDALE ESTATE.	SANTA MARTA ESTATE.	SOCONUSCO ESTATE.	PERSEVERANCE ESTATE.	EL SALVADOR ESTATE.	ROXBURGH ESTATE.
	Increase or decrease on average of crops 1912–14.—2 years.	Increase or decrease on average of crops 1912–14.—2 years.	Increase or decrease on average of crops 1912–14.—2 years.	Increase or decrease on average of crops 1912–14.—2 years.	Increase or decrease on average of crops 1912–14.—2 years.	Increase or decrease on average of crops 1912–14.—2 years.	Increase or decrease on average of crops 1912–14.—2 years.	Increase or decrease on average of crops 1912–14.—2 years.
	Pods per tree.							Lb. wet cacao per acre.
	*	*	*	*	*	*	*	
1	— 8·97	—10·21	—17·08	— 8·61	— 6·90	—11·90	— 6·44	504
2	— 6·17	— 2·48	—15·68	— 2·55	— 9·83	—17·42	— 8·56	865
3	— 0·52	— 5·73	—13·08	— 4·53	— 8·89	—15·88	—13·70	515
4	— 4·40	— 0·97	—13·90	— 2·33	— 6·50	—11·97	— 9·61	826
5	— 3·83	0·65	—17·60	— 5.82	—10·15	—19·41	—16·44	658
6	— 3·82	— 0·60	— 8·86	— 5·56	— 9·50	—11·85	— 8·92	701
7	— 5·54	— 1·24	—12·95	— 5·30	—10·83	—11·01	— 8·96	867
8	—16·49	— 2·16	—15·37	— 4·37	— 9·61	—15·43	— 1·45	638
9	—15·63	1·90	—14·68	—11·11	— 7·74	— 9·89	— 0·93	516
10	—11·68	0·51	—13·51	— 6·09	— 8·63	—16·16	— 5·73	554
11	—15·86	— 2·63	—13·15	— 3·49	— 8·71	—15·63	— 5·66	785
12	—14·58	4·44	—13·38	—13·40	— 6·11	—13·51	— 1·76	961
13	—21·16	— 0·67	—15·12	—12·40	— 4·69	—15·62	— 4·76	557
14	—21·12	— 9·90	—12·47	—11·03	— 8·18	—15·90	— 4·34	518
15	— 4·52	— 8·89	—11·63	—12·77	— 8·72	—10·20	— 8·07	620
16	— 6·05	— 2·71	—10·02	— 8·95	— 8·86	— 9·50	—10·09	240
17	— 8·66	0·34	— 9·01	—11·45	— 9·25	— 7·18	— 5·18	155
18	— 5·49	— 1·38	—11·09	— 8·43	— 6·66	— 7·52	— 5·97	54
19	—12·76	3·58	—10·91	— 7·34	—10·71	— 5·39	— 7·71	359
20	— 7·02	9·49	—10·77	— 8·97	— 8·07	— 7·31	— 6·26	227
21	— 5·82	8·77	—16·27	—11·41	—10·36	— 4·54	— 3·35	504
22	...	...	...	...	— 5·75	...	...	578
23	...	...	...	...	...	...	...	778
24	...	...	...	...	...	...	...	—267

* Dividing the figures in these columns by 2 gives approximately the number of bags (165 lb.) dry cacao per 1,000 trees.

The results recorded in Tables X and XI, have been obtained without the application of any manures, and as far as each estate is concerned the cultivation of the plots has been identical. The difference therefore between the yield of one crop and another is undoubtedly due to seasons and to the increasing age of the trees, when these have not yet attained their full bearing capacity, although the increase in yield from the latter cause may not be very marked from one year to the next.

The variation in the yield between the various plots on each estate for the same crop, as pointed out in previous reports, is due to the relative productiveness of the particular group of trees forming each plot, and is largely dependent on the relative porportion of heavy and poor bearing trees thereon. It will be observed that these differences are not uniform, that is, the plots do not increase or decrease in the same proportion from one year to another.

These facts further tend to prove the statement made in previous reports viz :—that in order to be able to arrive more readily at reliable conclusions, as to the relative value of different manures applied to cacao trees, it is necessary to ascertain the natural yield of the plots over a series of years, previous to the application of the manures.

It is interesting to note the difference between the highest and lowest yielding plots on each estate. The figures recorded are shown in Table XII.

TABLE XII.—NATURAL YIELD OF PLOTS.

RETURNS OF HIGHEST AND LOWEST PLOT ON EACH ESTATE.

	AVERAGE NUMBER OF PODS PICKED PER TREE.														Av'ge. No. of lb. wet cacao picked ⅌ acre.	
	LA RETRAITE ESTATE.		LA COMPENSACION ESTATE.		EVASDALE ESTATE.		SANTA MARTA ESTATE.		SOCONUSCO ESTATE.		PERSEVERANCE ESTATE.		EL SALVADOR ESTATE.		ROXBURGH ESTATE.	
	Average for 2 years 1912-14.	1914-15.	Average for 2 years 1912-14.	1914-15.	Average for 2 years 1912-14.	1914-15.	Average for 2 years 1912-14.	1914-15.	Average for 2 years 1912-14.	1914-15.	Average for 2 years 1912-14.	1914-15.	Average for 2 years 1912-14.	1914-15.	Average for 2 years 1912-14.	1914-15.
ighest	36·73	18·51	28·58	32·16	37·02	19·94	28·00	21·62	36·93	26·57	48·25	32·82	56·76	41·95	2,122	2,511
owest	12·93	5·30	16·55	14·07	18·75	9·74	18·48	9·51	18·94	11·62	16·91	8·69	35·01	29·98	1,103	1,086
fference	23·80	13·21	12·03	18·09	18·27	10·20	9·52	12·11	17·99	14·95	31·34	24·13	21·75	11·97	1,019	1,425

It is evident from the above figures that it would be absolutely erroneous to consider any one plot as a control for any series of plots.

The cacao reaped from the *natural yield* plots has been cured, dried and weighed separately with the object of further ascertaining the number of pods required to produce a pound of dry cacao.

The results obtained for the three years are recorded in Table XIII.

TABLE XIII.

NAME OF ESTATE.	TOTAL NUMBER OF PODS PICKED.			LB. DRY CACAO.			NO. OF PODS PER LB. DRY CACAO.		
	1912-13.	1913-14.	1914-15.	1912-13.	1913-14.	1914-15.	1912-13.	1913-14.	1914-15.
La Retraite ...	30,797	57,498	24,500	2,095	3,873	1,646	14·70	14·84	14·88
La Compensacion	37,364	53,028	40,525	3,281	4,674	3,663	11·39	11·34	11·06
Evasdale ..	39,459	70,856	27,635	3,391	6,377	2,391	11·64	11·11	11·56
Santa Marta ..	44,031	60,834	35,406	3,698	4,946	2,961	11·91	12·30	11·96
Soconusco ..	59,515	66,530	44,345	4,200	4,696	3,098	14·17	14·17	14·31
Perseverance ...	71,406	56,600	39,005	4,761	4,346	2,768	15·00	13·02	14·09
El Salvador ...	83,765	90,876	72,622	7,118	7,723	6,298	11·77	11·77	11·53

NATURAL YIELD OF INDIVIDUAL TREES.

All the trees in the first seven plots of the *natural yield* experiments on the La Retraite, Evasdale, Soconusco, Perseverance and Roxburgh estates have been labelled and the number of pods picked from each tree recorded. The returns are very interesting and the percentage of trees in each plot bearing less than 13 pods per tree annually, from 13 to 25 pods per tree, etc., for each estate respectively, has been calculated. The results obtained for the past three years are given in Tables XIV to XVIII.

TABLE XIV.—NATURAL YIELD OF INDIVIDUAL TREES ON LA RETRAITE ESTATE.

Trees 20 to 22 years old in 1912.

Plot.	Number of trees.	Crop, Sep. 1, to August 31.	PER CENT. OF TREES BEARING THE FOLLOWING NUMBER OF PODS IN EACH YEAR.						Average number of pods picked per tree.
			0-12.	13-25.	26-50.	51-75.	76-100.	Over 100.	
1	94	1912–13	50·0	30·8	16·0	2·1	...	1·1	16·33
	94	1913–14	36·2	17·0	33·0	10·6	3·2	...	26·78
	92	1914–15	58·7	26·1	15·2	...	...	...	12·58
2	103	1912–13	60·2	22·3	14·6	1·9	1·0	...	13·99
	101	1913–14	24·7	25·7	27·7	13·9	4·0	4·0	32·40
	101	1914–15	45·5	27·7	24·8	1·0	1·0	...	16·94
3	98	1912–13	69·4	18·4	9·2	3·0	...	...	11·41
	98	1913–14	35·7	23·5	22·4	14·3	3·1	1·0	26·66
	98	1914–15	47·0	26·5	21·4	3·1	1·0	1·0	18·51
4	91	1912–13	58·2	23·1	16·5	1·1	1·1	...	14·14
	91	1913–14	40·6	19·8	22·0	8·8	5·5	3·3	28·54
	89	1914–15	59·5	16·9	18·0	3·4	1·1	1·1	16·94
5	100	1912–13	70·0	13·0	14·0	3·0	...	...	11·87
	98	1913–14	38·8	17·3	27·6	14·3	...	2·0	26·18
	97	1914–15	52·6	25·8	19·6	1·0	...	1·0	15·16
6	97	1912–13	69·1	19·6	7·2	4·1	...	...	11·54
	96	1913–14	41·7	21·9	27·1	8·3	...	1·0	22·01
	91	1914–15	53·8	30·8	14·3	1·1	...	...	12·93
7	94	1912–13	66·0	19·1	12·8	2·1	...	...	11·21
	94	1913–14	43·6	18·1	27·7	7·4	3·2	...	22·58
	92	1914–15	67·4	18·5	13·0	1·1	...	...	11·36
Average for 3 years			51·8	22·0	19·2	5·0	1·2	0·8	

TABLE XV.—NATURAL YIELD OF INDIVIDUAL TREES ON EVASDALE ESTATE.

Trees 18 to 19 years old in 1912.

Plot.	Number of trees.	Crop, Sep. 1, to Aug. 31.	PER CENT. OF TREES BEARING THE FOLLOWING NUMBER OF PODS IN EACH YEAR.						Average No. of pods picked per tree.
			0–12	13–25	26–50	51–75	76–100	Over 100	
1	110	1912–13	38·2	18·2	21·8	13·6	5·5	2·7	29·66
	106	1913–14	14·2	20·7	32·1	14·1	10·4	8·5	44·65
	106	1914–15	43·4	26·4	22·6	6·6	...	1·0	19·94
2	94	1912–13	31·9	24·5	26·6	7·4	6·4	3·2	30·65
	92	1913–14	27·2	14·1	29·3	15·2	9·8	4·4	38·55
	89	1914–15	47·2	23·6	20·2	6·7	2·3	...	18·88
3	96	1912–13	45·8	27·1	15·6	10·4	...	1·1	20·93
	96	1913–14	28·1	17·7	31·3	10·4	7·3	5·2	35·80
	95	1914–15	55·8	22·1	17·9	4·2	...	...	15·28
4	98	1912–13	44·9	23·5	24·5	5·1	1·0	1·0	21·26
	98	1913–14	21·4	24·5	25·5	17·4	10·2	1·0	35·49
	98	1914–15	62·3	18·4	16·3	2·0	...	1·0	14·48
5	101	1912–13	37·6	28·7	24·8	5·9	3·0	...	21·76
	100	1913–14	18·0	15·0	33·0	17·0	13·0	4·0	42·22
	99	1914–15	59·6	23·2	12·1	5·1	...	...	14·34
6	66	1912–13	53·1	22·7	18·2	3·0	3·0	...	18·48
	66	1913–14	21·2	22·7	40·9	9·1	6·1	...	29·65
	66	1914–15	56·0	22·7	16·7	4·6	...	...	15·21
7	104	1912–13	51·9	17·3	21·2	6·7	2·9	...	19·42
	102	1913–14	32·3	20·6	20·6	20·6	3·9	2·0	32·14
	100	1914–15	67·0	20·0	9·0	3·0	1·0	...	12·77
Average for 3 years			**40·8**	**21·6**	**22·9**	**8·9**	**4·1**	**1·7**	

TABLE XVI—NATURAL YIELD OF INDIVIDUAL TREES ON SOCONUSCO ESTATE.

Trees over 50 years old in 1912.

Plot.	Number of trees.	Crop, Sep. 1, to Aug. 31.	PER CENT. OF TREES BEARING THE FOLLOWING NUMBER OF PODS IN EACH YEAR.						Average No. of pods picked per tree.
			0–12	13–25	26–50	51–75	76–100	Over 100	
1	105	1912–13	28·6	30·5	31·4	8·6	0·9	...	25·44
	105	1913–14	29·5	31·4	30·5	3·8	4·8	...	24·88
	105	1914–15	42·9	33·3	21·0	1·9	0·9	...	18·14
2	110	1912–13	38·2	19·1	25·5	8·2	5·4	3·6	30·29
	110	1913–14	28·2	28·2	30·9	7·3	5·4	...	26·44
	107	1914–15	44·9	29·9	20·5	1·9	1·9	0·9	18·53
3	110	1912–13	35·5	20·9	22·7	14·6	3·6	2·7	30·02
	110	1913–14	27·3	21·8	31·8	14·6	2·7	1·8	30·94
	108	1914–15	36·1	33·4	22·2	6·5	0·9	0·9	21·59
4	...	1912–13	...	...	No records				
	101	1913–14	19·8	25·7	39·6	7·9	4·0	3·0	33·53
	101	1914–15	31·7	26·7	30·7	6·9	4·0	...	25·11
5	...	1912–13	...	...	No records				
	97	1913–14	27·8	24·7	29·9	8·3	8·3	1·0	29·85
	97	1914–15	43·3	26·8	20·6	6·2	2·1	1·0	20·07
6	...	1912–13	...	...	No records			...	
	109	1913–14	25·7	16·5	31·2	17·4	6·4	2·8	35·81
	109	1914–15	34·9	29·4	19·3	12·8	1·8	1·8	25·88
7	...	1912–13	...	...	No records				
	113	1913–14	20·4	22·1	34·5	16·8	5·3	0·9	33·69
	113	1914–15	30·1	42·5	19·5	4·4	2·6	0·9	22·91
Average for 2 years (1913–15.)			31·6	28·0	27·3	8·3	3·7	1·1	

TABLE XVII.—NATURAL YIELD OF INDIVIDUAL TREES ON PERSEVERANCE ESTATE.

Trees 40 to 45 years old in 1912.

Plot.	Number of trees.	Crop, Sep. 1, to August 31.	Per cent. of Trees Bearing the following Number of Pods in each Year.						Average number of pods picked per tree.
			0-12.	13-25.	26-50.	51-75.	76-100.	Over 100.	
1	96	1912–13	18·7	19·8	36·5	14·6	6·2	4·2	40·72
	95	1913–14	36·8	29·5	21·1	7·4	4·2	1·0	23·25
	95	1914–15	45·3	26·3	22·1	4·2	...	2·1	20·13
2	98	1912–13	18·4	15·3	39·8	19·4	5·1	2·0	37·29
	98	1913–14	18·3	23·5	29·6	18·4	6·1	4·1	36·86
	98	1914–15	46·9	19·4	24·5	9·2	...	...	19·66
3	102	1912–13	16·6	21·6	35·3	14·7	5·9	5·9	39·31
	102	1913–14	17·7	22·6	33·3	19·6	2·9	3·9	36·16
	102	1914–15	44·1	17·6	30·4	5·9	1·0	1·0	21·85
4	106	1912–13	33·0	22·6	27·4	9·4	3·8	3·8	29·22
	104	1913–14	44·2	16·4	24·0	10·6	1·9	2·9	25·33
	103	1914–15	59·2	18·5	13·6	8·7	...	...	15·32
5	96	1912–13	18·8	25·0	26·0	18·8	10·4	1·0	37·79
	94	1913–14	16·0	20·2	40·4	11·7	8·5	3·2	37·16
	94	1914–15	48·9	30·8	12·8	6·4	1·1	...	18·06
6	97	1912–13	25·8	15·5	37·1	13·4	6·2	2·0	33·30
	97	1913–14	25·8	19·6	37·1	13·4	3·1	1·0	31·19
	97	1914–15	52·6	18·5	15·5	10·3	1·0	2·1	20·40
7	92	1912–13	19·6	16·3	37·0	14·1	7·6	5·4	39·41
	92	1913–14	17·4	14·1	38·0	21·8	6·5	2·2	39·23
	92	1914–15	28·3	19·6	36·9	10·9	4·3	...	28·31
Average for 3 years ...			**31·1**	**20·6**	**29·4**	**12·5**	**4·1**	**2·3**	

TABLE XVIII.—NATURAL YIELD OF INDIVIDUAL TREES ON ROXBURGH ESTATE.

Trees 9 years old in 1912.

Plot.	Number of trees.	Crop, Sep. 1, to Aug. 31.	PER CENT. OF TREES BEARING THE FOLLOWING NUMBER OF PODS IN EACH YEAR.						Average number of pods picked per tree.
			0-12.	13-25.	26-50.	51-75.	76-100.	Over 100.	
1	78	1912–13	9·0	17·9	28·2	23·1	10·3	11·5	51·18
	78	1913–14	10·2	7·7	38·5	24·4	15·4	3·8	51·05
	78	1914–15	3·9	9·0	27·0	30·8	11·5	17·8	64·90
2	78	1912–13	15·4	21·8	34·6	20·5	6·4	1·3	37·06
	78	1913–14	10·2	14·1	42·3	29·5	2·6	1·3	41·13
	78	1914–15	5·1	9·0	32·0	29·5	15·4	9·0	56·68
3	77	1912–13	24·7	23·4	29·8	16·9	5·2	...	31·52
	76	1913–14	18·4	23·7	39·5	17·1	1·3	...	33·62
	76	1914–15	7·9	19·7	30·3	25·0	15·8	1·3	47·22
4	78	1912–13	18·0	17·9	41·0	16·7	3·8	2·6	36·65
	78	1913–14	19·2	20·5	38·5	12·8	6·4	2·6	36·26
	78	1914–15	6·4	11·5	29·5	27·0	14·1	11·5	57·97
5	78	1912–13	14·1	16·7	47·4	19·2	2·6	...	34·76
	78	1913–14	23·1	15·4	41·0	12·8	6·4	1·3	34·62
	77	1914–15	3·9	6·5	41·5	31·2	11·7	5·2	53·41
6	78	1912–13	12·8	28·2	38·5	19·2	1·3	...	33·76
	78	1913–14	14·1	24·4	39·7	16·7	5·1	...	34·81
	78	1914–15	3·8	10·3	37·2	35·9	7·7	5·1	51·45
7	78	1912–13	23·1	21·8	33·3	19·2	2·6	...	31·19
	78	1913–14	18·0	19·2	43·6	14·1	3·8	1·3	36·58
	78	1914–15	3·8	15·4	29·5	23·1	19·2	9·0	56·64
Average for 3 years...			**12·6**	**17·0**	**36·3**	**22·1**	**8·0**	**4·0**	

TABLE XIX.—COMPARATIVE RETURN OF PERCENTAGE OF TREES BEARING THE INDICATED NUMBER OF PODS EACH YEAR, BASED ON AVERAGES IN TABLES XIV TO XVIII.

Estate.	Age of trees in 1912.	No. of years of observation.	PERCENTAGE OF TREES BEARING THE FOLLOWING NUMBER OF PODS.					
			0-12.	13-25.	26-50.	51-75.	76-100.	Over 100.
La Retraite...	20-22	3	51·8	22·0	19·2	5·0	1·2	0·8
Evasdale ...	18-19	3	40·8	21·6	22·9	8·9	4·1	1·7
Soconusco ...	Over 50	2	31·6	28·0	27·3	8·3	3·7	1·1
Perseverance	40-45	3	31·1	20·6	29·4	12·5	4·1	2·3.
Roxburgh ...	„	3	12·6	17·0	36·3	22·1	8·0	4·0

The figures recorded in the preceding tables XIV to XIX show;—

1. That a large proportion of the trees in these plots, give less than a pound of dry cacao per annum even for a very favourable year such as that of 1913-14.

2. That although a favourable season considerably reduces the percentage of trees bearing less than a pound of dry cacao per annum, the proportion of these is probably not less than 20 per cent. on an average.

3. That the comparative yield of the plots on each estate for each year is largely dependent on the relative proportion of high and low bearing trees thereon, and that generally the percentage of trees bearing less than 13 pods per tree appears to exert the largest influence on the relative yield of the plots.

Generally it has been observed that the heavy bearing trees of the first year have continued to be heavy bearers, and that the poor yielding trees have remained poor during subsequent years.

Although these remarks apply to plots of approximately 100 trees each, they are equally true with regard to whole fields as observed at River Estate. The question of detecting the poor bearing trees on an estate and having them replaced by trees raised from selected stock, or budded or grafted trees, of known prolific and other good qualities is deserving of the most serious consideration by planters.

It might be pointed out that although the trees on the Roxburgh estate are the youngest under experiment and have not yet reached their full bearing capacity they show the smallest percentage of poor bearing trees *i.e.* trees bearing less than 26 pods annually *vide* Table XVIII. This may be attributed to the fact that the selection of pods for planting purposes receives the careful attention of the proprietor. This question of seed selection has been and is unfortunately still too frequently neglected on the majority of the estates. The possibility of improving the crop of poor yielding fields on an estate, by cutting out and replacing trees bearing an average of less than 13 pods per tree, appears to be clearly indicated and should form part of the experiments to be made later on the *natural yield* plots.

METEOROLOGY.

RAINFALL RETURN FROM JULY TO SEPTEMBER, 1916.

Stations.	July, 1916.	August, 1916.	Septr., 1916.	Jany. to Sept., 1916.	Jany. to Sept., 1915.
	Ins.	Ins.	Ins.	Ins.	Ins.
North-west District.					
St. Clair—Royal Botanic Gardens	8·04	11·57	10·78	51·75	37·44
Port-of-Spain—Colonial Hospital	5·65	10·60	7·22	23·47	28·91
„ Royal Gaol...	5·93	10·92	6·50	40·40	34·85
„ Constabulary Headquarters ...	5·17	11·77	8·67	41·13	24·65
St. Ann's—Reservoir	8·21	12·19	11·78	54·58	43·04
Maraval— „	10·94	14·25	10·68	62·72	45·93
„ Constabulary Station	9·65	17·10	10·13	62·90	56·33
Diego Martin—Constabulary Station	8·12	13·16	10·84	61·79	49·71
„ Waterworks	5·55	12·62	8·94	55·23	45·15
„ River estate	6·01	12·06	8·25	54·43	46·44
Fort George Signal Station	6·40	12·62	11·56	54·33	42·43
North Post „	5·08	11·47	5·51	47·24	39·72
Carenage Constabulary Station	6·79	17·61	11·54	62·17	49·82
Carrera Island Convict Depôt	8·06	8·85	5·26	37·39	31·23
Chacachacare Lighthouse	5·20	6·22	3·41	29·36	33·01
Santa Cruz—Maracas District.					
Santa Cruz—Constabulary Station	10·49	22·36	15·06	70·22	44·38
St. Joseph—Government Farm	6·16	7·12	5·70	39·17	41·45
„ Constabulary Station	5·15	8·38	4·84	32·59	26·92
Tunapuna—St. Augustine estate	4·83	9·20	3·43	34·02	38·00
Maracas—Government School	4·00	27·50	11·65	69·05	40·64
„ Ortinola estate	9·23	16·84	9·06	61·05	43·32
Caura—Wardour estate	7·04	15·37	7·97	50·59	39·48
West Central District.					
Caroni—Frederick estate	6·12	8·10	4·73	39·39	48·45
Chaguanas—Constabulary Station	5·74	8·99	6·86	36·46	46·44
„ Woodford Lodge estate	5·72	9·62	6·44	37·39	45·58
Carapichaima—Waterloo estate	6·90	11·53	7·42	42·89	39·16
„ Friendship Hall estate... ...	4·77	11·42	7·50	34·50	50·44
„ Waterloo Cacao estate	...	14·44	7·84	...	
Couva—Exchange estate	4·26	14·51	8·77	29·09	42·29
„ Brechin Castle estate	5·85	14·11	10·38	46·65	42·87
„ Perseverance „	4·50	12·07	10·40	40·66	37·32
„ Camden „	5·38	10·93	6·41	36·51	30·85
„ Milton „	5·74	15·37	11·75	52·31	51·61
„ Spring „	4·61	14·74	6·78	44·54	53·83
„ Constabulary Station	4·95	14·15	8·95	44·66	42·59
„ Esperanza estate, Savonetta	5·37	15·30	9·25	46·40	44·50
Montserrat District.					
Montserrat Constabulary Station	7·54	13·16	6·38	46·74	50·41
Brasso—La Vega estate	7·99	11·29	7·48	52·19	61·50
Santa Clara Estate	10·00	12·33	11·81	60·77	
Arima District.					
Arima—Warden's Office	6·42	9·57	7·90	44·44	40·23
„ Torrecilla estate	9·80	13·82	7·68	56·35	[illegible]
„ Verdant Vale estate	11·12	13·80	7·29	63·97	[illegible]
San Rafael—Constabulary Station	8·14	11·03	8·56	49·66	[illegible]
Guanapo—Talparo estate	6·89	10·76	6·50	49·90	[illegible]
„ San José Estate	10·68	11·67	9·79	64·09	[illegible]
Tamana—Sta. Marta estate	11·76	10·26	9·96	69·03	[illegible]
„ La Corona estate	12·03	15·31	12·84	80·76	[illegible]
San Fernando & Princes Town District.					
Clarton's Bay—Forres Park estate	8·47	15·43	7·65	[illegible]	[illegible]
Pointe-à-Pierre—Bonne Aventure est. ...	6·54	15·75	4·33	[illegible]	[illegible]
„ Concord estate	5·86	15·50	4·59	[illegible]	[illegible]
„ Plein Palais estate	6·40	13·76	5·00	[illegible]	[illegible]
Naparima—Picton estate	8·73	10·58	5·80	[illegible]	[illegible]
„ Usine St. Madeleine	8·10	12·53	6·23	[illegible]	[illegible]
...	6·00	11·12	6·15	[illegible]	[illegible]

RAINFALL RETURN FROM JULY TO SEPT., 1916.—Contd.

Stations.	July, 1916.	August, 1916.	Sept., 1916.	Jan. to Sep., 1916.	Jan. to Sep., 1915.
San Fernando and Princes Town District.—(Cont'd.)	Ins.	Ins.	Ins.	Ins.	Ins.
Naparima—Lewisville	8·23	16·65	7·60	55·21	51·27
,, Tarouba estate	3·84	13·86	4·66	33·31	36·23
,, Union Hall ,,	8·51	12·67	5·05	45·53	35·36
,, Palmiste ,,	8·63	12·67	6·06	48·38	48·17
,, Hermitage ,,	6·20	10·42	4·96	38·00	43·11
Princes Town—Craignish ,,	7·46	12·08	7·65	47·67	48·02
,, Cedar Hill estate	8·82	10·73	6·81	47·79	47·50
,, Williamsville estate	8·17	15·18	5·77	52·81	57·74
,, Esmeralda estate	7·43	9·82	6·24	47·93	51·66
,, New Grant estate	7·17	15·31	6·43	52·17	62·18
,, Constabulary Station	7·21	11·62	6·84	33·98	34·17
,, Hindustan estate	8·60	15·42	6·44	56·13	54·56
,, La Retraite estate	10·28	18·73	9·41	75·12	69·51
,, Malgretoute estate	9·81	14·14	7·91	43·38	50·23
Savana Grande—Friendship & Ben Lomond estates	8·98	15·04	7·88	51·68	49·90
Poole—El Rosario estate ...	11·63	10·44	7·85	64·42	71·90
Naparima, Petit Morne estate	8·87	11·28	5·69	42·91	...
South-west District.					
Oropuche—Constabulary Station	7·88	8·00	8·32	44·21	48·02
,, Pluck estate	5·71	10·78	3·76	42·63	45·56
Siparia—Constabulary Station	4·81	11·54	4·99	43·19	60·18
,, Alta Gracia estate	6·14	12·20	5·63	49·39	44·94
Guapo—Adventure estate	6·84	10·49	8·12	48·82	42·05
Point Fortin—Constabulary Station	7·31	12·83	8·98	59·04	51·22
Erin—La Ressource estate	4·58	6·64	6·37	31·42	37·39
,, La Union estate	5·22	7·88	7·33	38·83	...
,, Industry estate ...	4·65	7·97	7·00	38·75	39·83
Cedros—La Retraite estate	4·52	18·73	6·24	66·61	40·52
,, Constabulary Station	5·41	6·50	6·20	43·21	32·41
,, Beaulieu estate	5·73	6·05	5·34	41·78	...
,, Perseverance estate	5·10	6·34	6·13	43·63	32·32
,, St. Marie estate	4·56	5·90	5·68	42·99	30·52
Icacos —Constance estate ...	8·25	7·48	8·03	53·35	31·70
Irois—Government School...	4·88	7·74	8·28	56·02	38·90
South Coast.					
Moruga—Constabulary Station	10·43	12·23	6·50	51·78	45·66
East Coast.					
Matura—La Juanita estate	7·37	11·93	9·68	60·73	70·25
Manzanilla—Constabulary Station	10·06	8·34	6·65	55·94	63·62
Sangre Grande—San Hilario estate	10·69	10·67	5·12	55·25	...
,, New Lands estate	12·81	8·95	9·04	61·85	66·19
,, Evasdale estate	11·03	9·90	8·72	64·15	69·12
,, Grosvenor estate	9·83	10·06	8·13	62·79	71·88
Mayaro—Constabulary Station	11·20	16·37	6·75	59·44	50·95
North Coast.					
Blanchisseuse—Constabulary Station	3·88	16·08	7·96	55·86	46·82
Grande Rivière—Mon Plaisir estate	10·94	12·03	10·09	72·74	61·37
Toco—Aragua House	6·43	16·06	6·81	57·14	53·18
,, Constabulary Station	4·91	15·71	4·51	48·69	51·12
Point Galera—Light House	3·63	11·61	5·34	38·22	37·03
Tobago.					
Tobago—Hermitage estate	7·73	20·11	8·05	67·48	60·49
,, Riversdale ,,	7·72	14·93	10·35	54·40	45·02
,, King's Bay ,,	7·43	16·30	12·08	63·47	56·67
,, Roxburgh	5·88	16·97	12·58	71·30	69·77
,, Lure estate	5·49	14·27	8·31	58·15	67·81
,, Botanic Station	4·20	11·01	8·33	45·74	49·20
,, Government Farm	2·48	10·83	6·76	35·31	34·81
Lowlands estate	3·24	12·88	7·61	39·46	43·66
,, Friendship estate	2·35	11·16	8·95	39·51	51·81
,, Bon Accord estate	0·97	8·52	8·10	34·89	43·94

NOTES.

The Diego Martin Agricultural Credit Society, the first to be formed in the Colony under the recent Ordinance, was registered on October 12, 1916. His Excellency the Governor presided at the first meeting of the new Society on October 14, when Mr. W. G. Freeman gave an address on the "Working of Agricultural Credit Societies."

The Board of Agriculture has made provision in its Estimates for 1917 for the appointment of two more Agricultural Inspectors, thus raising the number to five.

The Board of Agriculture has instituted a series of Prize Competitions in Tobago for 1917. The following prizes are offered:—

Cacao.—Class 1, 10 acres with at least 5 in bearing; $25, $15 and $10.

Class 2, under 10 acres with at least 2 in bearing; $15, $10 and $5.

Tobacco.—$15 for the best quarter-acre or over, and $6, $4 and $2 for the best plots of tobacco between one-eighth and one-quarter acre.

A vegetable competition is also announced for 1917. Competitors will receive instruction and advice free from the resident Agricultural Inspector, Mr. F. D. Davis.

Members of the Sangre Grande District Agricultural Society visited River Estate on November 15, and a party from the Arima Society visited St. Augustine Experiment Station and the Government Farm on November 18.

The Board of Agriculture has made a grant of £25 in aid of the Farriery classes of the Board of Industrial Training. These practical courses of instruction are given in various districts of the Colony.

(*Bulletin, Department Agriculture, Trinidad & Tobago*, pp. 183–208. Issued Nov. 24, '16).

BULLETIN

OF THE

DEPARTMENT OF AGRICULTURE, TRINIDAD AND TOBAGO.

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VOLUME XVI, 1917.

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BULLETIN
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DEPARTMENT OF AGRICULTURE,
Trinidad and Tobago.

PART 1.] 1917. [VOL. XVI.

SUGAR.

SUGAR CANE EXPERIMENTS 1914-16.

Results of Monthly Tests of Varieties.

BY JOSEPH DE VERTEUIL, F.C.S.,
Superintendent of Field Experiments.

AT a meeting of the Experiments Committee of the Board of Agriculture held on May 22, 1914 it was decided that "tests of varieties of canes be made on heavy and light soils to ascertain the kinds best suited to each soil and their relative times of maturity.

"That if possible ten varieties of cane be tried, including Bourbon in each set, planted 5 by 3 feet, single plants, and fall planting only; each plot to be not less than half an acre but preferably one acre.

"The juice of the canes to be tested at 15 months and thence monthly."

Five estates were asked to give facilities for carrying out the experiments but, for one reason or another, only two accepted—Brechin Castle and Caroni. At Caroni, only five varieties were planted on light soil.

The results obtained are recorded in Tables I to VI.

Tables III, IV and VI give the factory results for Brechin Castle and Caroni respectively. The figures recorded in these tables were supplied by the estate authorities and generally, the results compare favourably with those obtained from the small mill, at the Government Farm, although the weight of the samples tested with the small mill was only 80 to 120 pounds of cane for each variety.

It was thought that useful information might be obtained by testing the newer varieties planted in the Board's nursery at St. Augustine Experiment Station and also the different varieties, about forty in number, which had been planted on the St. Augustine estate. These were accordingly included in the experiments, although the area planted was in most cases less than half an acre.

The results are given in Tables VII and IX. Tables VIII and X give the results respectively from the canes planted on December 10, 1914 in the Board's nursery No. 2 and of the "spring" plants from Field 3 on the St. Augustine estate.

Information with regard to the date and area planted, manures applied, date of testing and the rainfall for a month or so previous to each testing is given at the head of the tables.

BRECHIN CASTLE ESTATE.

TABLE I.—LIGHT SOIL—FIELD "THREE ROW," BRECHIN CASTLE.

Results from Small Mill.

Field ... ..."Three Row."—Light soil—Clay loam.

Area planted ...Each plot = 25,200 square feet.

Date planted ...September 19, 1914.

Manures applied...About 10 tons pen manure per acre and 2 cwt. Estate's mixture.

Date tested	(*a*) December 21, 1915	15 months old.
	(*b*) January 25, 1916	About 16 months old.
	(*c*) February 29, 1916	About 17 months old.
	(*d*) April 7, 1916	18½ months old.
Rainfall	December 1 to 20, 1915	2·08 in.
	December 21, 1915 to January 24, 1916 ...	6·64 „
	January 25 to February 28, 1916 ...	0·70 „
	February 29 to April 6, 1916	1·47 „

CANE.		JUICE.								PER ACRE.		
		Per cent. extracted.	Specific gravity.	Brix.	Percentage of Sucrose.	Percentage of Glucose.	Percentage of Non-Sugar.	Quotient of purity.	Sucrose per gallon.	Canes.	Juice.	Sucrose in juice.
									Lb.	Tons.	Galls.	Tons.
Badilla ...	(*a*)	59·0	1·0717	17·4	14·97	1·60	0·83	86·0	1·604			
	(*b*)	62·4	1·0850	20·4	17·81	0·92	1·67	87·3	1·932			
	(*c*)	63·7	1·0877	21·0	19·06	0·94	1·00	90·8	2·073			
	(*d*)	62·6	1·0923	22·0	20·51	0·58	0·91	93·2	2·240	28·96	3,718	3·72
B. 6450 ...	(*a*)	67·7	1·0570	14·0	10·25	2·40	1·35	73·2	1·083			
	(*b*)	66·8	1·0574	14·1	10·84	1·70	1·56	76·9	1·146			
	(*c*)	66·6	1·0717	17·4	14·63	1·43	1·34	84·1	1·568			
	(*d*)	68·2	1·0810	19·5	17·54	0·48	0·98	89·9	1·896	29·67	4,193	3·55
D. 109 ...	(*a*)	64·9	1·0617	15·1	11·43	2·53	1·14	75·7	1·213			
	(*b*)	63·7	1·0626	15·3	11·47	2·30	1·53	75·0	1·219			
	(*c*)	64·9	1·0726	17·6	14·42	1·78	1·40	81·9	1·547			
	(*d*)	61·4	1·0770	18·6	15·38	1·75	1·47	82·7	1·656	37·18	4,748	3·51
B. 1753 ...	(*a*)	63·9	1·0536	13·2	8·80	3·20	1·20	66·7	0·927			
	(*b*)	63·4	1·0643	15·7	12·58	1·92	1·20	80·1	1·339			
	(*c*)	62·1	1·0753	18·2	15·12	1·72	1·36	83·1	1·626	36·22	4,685	3·40
	(*d*)	63·4	1·0713	17·3	14·69	1·29	1·32	84·9	1·574			
B. 347 ...	(*a*)	67·6	1·0506	12·5	7·34	3·00	2·16	58·7	0·771			
	(*b*)	68·6	1·0596	14·6	10·92	2·30	1·38	74·8	1·157			
	(*c*)	67·0	1·0717	17·4	14·24	1·85	1·31	81·8	1·526			
	(*d*)	66·6	1·0730	17·7	14·27	1·88	1·55	80·6	1·531	34·29	4,767	3·26
D. 3956 ...	(*a*)	65·4	1·0578	14·2	9·95	2·82	1·43	70·1	1·052			
	(*b*)	66·2	1·0557	13·7	9·57	2·70	1·43	69·8	1·010			
	(*c*)	66·3	1·0704	17·1	13·24	2·27	1·59	77·4	1·417			
	(*d*)	65·6	1·0832	20·0	16·59	1·69	1·72	82·9	1·797	29·41	3,990	3·20
D. 116 ...	(*a*)	62·6	1·0583	14·3	10·04	2·67	1·59	70·2	1·062			
	(*b*)	66·1	1·0609	14·9	11·25	2·09	1·56	75·5	1·193			
	(*c*)	63·7	1·0744	18·0	14·84	1·85	1·31	82·4	1·594			
	(*d*)	64·7	1·0779	18·8	16·04	1·53	1·23	85·3	1·729	30·85	4,148	3·20
B. 156 ...	(*a*)	63·7	1·0578	14·2	10·44	2·67	1·09	73·5	1·104			
	(*b*)	62·7	1·0687	16·7	14·28	1·44	0·98	85·5	1·526			
	(*c*)	62·6	1·0739	17·9	15·04	1·67	1·19	84·0	1·615	30·05	3,923	2·83
	(*d*)	63·0	1·0722	17·5	14·24	1·69	1·57	81·4	1·527			

TABLE II.—HEAVY SOIL—FIELD "GRU GRU," BRECHIN CASTLE.

Results from Small Mill.

Field ...	..."Gru Gru."—Heavy soil—Clay.
Area planted	...Each plot = 36,750 square feet.
Date planted	...October 10, 1914.
Manures applied	...About 10 tons pen manure per acre and 2 cwt. Estate's mixture.
Date tested	(*a*) January 25, 1916 ... ... 15½ months old. (*b*) February 29, 1916 ... ... 16⅔ months old (*c*) April 7, 1916 ... ... Nearly 18 months old.
Rainfall	January 1 to 24, 1916 ... ... 5·24 ins. January 25 to February 28, 1916 ... 0·79 „ February 29 to April 6, 1916 ... ... 1·47 „

CANE.		JUICE.								PER ACRE.		
		Per cent. extracted.	Specific gravity.	Brix.	Percentage of Sucrose.	Percentage of Glucose.	Percentage of Non-sugar.	Quotient of purity.	Sucrose per gallon.	Canes.	Juice.	Sucrose in juice.
									Lb.	Tons.	Galls.	Tons.
B. 347 ...	(*a*)	68·9	1·0587	14·4	10·04	2·55	1·81	69·7	1·063			
	(*b*)	68·1	1·0695	16·9	13·39	2·27	1·24	79·2	1·432			
	(*c*)	68·0	1·0783	18·9	16·18	1·58	1·14	85·6	1·745	26·88	3,797	2·96
D. 109 ...	(*a*)	64·8	1·0643	15·7	12·38	1·92	1·40	78·8	1·318			
	(*b*)	64·2	1·0726	17·6	14·08	1·92	1·60	80·0	1·510			
	(*c*)	64·5	1·0775	18·7	16·15	1·75	0·80	86·4	1·740	26·59	3,565	2·77
D. 116 ...	(*a*)	66·6	1·0591	14·5	11·17	2·09	1·24	77·0	1·183			
	(*b*)	65·3	1·0761	18·4	15·49	1·78	1·13	84·2	1·667			
	(*c*)	64·7	1·0828	19·9	17·80	1·09	1·01	89·4	1·927	22·95	3,072	2·64
B. 6450 ...	(*a*)	68·0	1·0647	15·8	12·67	1·64	1·49	80·2	1·349			
	(*b*)	65·4	1·0726	17·6	14·76	1·61	1·23	83·9	1·583			
	(*c*)	65·0	1·0823	19·9	17·99	0·82	1·09	90·4	1·948	21·41	2,879	2·50
B. 1753 ...	(*a*)	65·8	1·0647	15·8	12·67	1·84	1·29	80·2	1·349			
	(*b*)	63·5	1·0748	18·1	15·51	1·67	0·92	85·7	1·667			
	(*c*)	62·1	1·0783	18·9	16·71	1·26	0·93	88·4	1·802	23·17	3,037	2·44
Badilla ...	(*a*)	65·0	1·0806	19·4	16·54	1·21	1·65	85·2	1·787			
	(*b*)	62·8	1·0850	20·4	18·34	1·00	1·06	89·9	1·990			
	(*c*)	61·9	1·0941	22·4	20·90	0·51	0·99	93·3	2·287	18·39	2,330	2·38
B. 156 ...	(*a*)	64·3	1·0665	16·2	13·48	1·48	1·24	83·2	1·438			
	(*b*)	62·5	1·0806	19·4	17·21	1·28	0·91	88·7	1·860			
	(*c*)	62·4	1·0837	20·1	18·07	0·98	1·05	89·9	1·958	21·14	2,727	2·38
D. 3956 ...	(*a*)	66·4	1·0626	15·3	11·96	2·42	0·92	78·2	1·271			
	(*b*)	65·2	1·0678	16·5	12·64	2·63	1·23	76·6	1·350			
	(*c*)	64·3	1·0855	20·5	18·28	1·58	0·64	89·2	1·984	18·82	2,497	2·21

The results recorded in Tables I and II show that none of the varieties were ripe before the end of February, for although, the Badilla showed a high percentage of sucrose on January 25, it will be seen that the sucrose content of the juice has risen monthly, and was over 20 per cent. on April 7.

On the light soil (Table I) the first canes to ripen were B. 1753, B. 156, and B. 347 followed by Badilla, D. 109 and D. 116.

On the heavy soil (Table II) none of the canes were apparently ripe before the beginning of April. The first canes to come to maturity being B. 156 and B. 1753 followed by the Badilla. On both light and heavy soils B. 6450 is the slowest cane to ripen.

It will also be observed that each variety has given a higher tonnage of canes per acre on the light than on the heavy soil; on the other hand the juice of the same varieties of canes grown on the heavy soil contained a larger percentage of sucrose. All the varieties gave a higher yield of sugar per acre from the light soil; the higher percentage of sucrose in the juice of the canes from the heavy soil not being sufficient to compensate for the larger tonnage of canes reaped from the light soil.

No returns are available for the Bourbon. This cane grew well until they were about six months old when they showed signs of dying back and two months later there were hardly more than 25 per cent. of the stools left alive. They were then dug out and the plot replanted with D. 109. This seedling gave a good return where the Bourbon failed to grow.

TABLE III.—LIGHT SOIL.—FIELD "THREE ROW," BRECHIN CASTLE.

Results from Factory—First mill juice.

CANE.	Date reaped and tested.	JUICE.					Per acre canes.
		Per cent. extracted.	Brix.	Per cent. Sucrose.	Quotient of purity.	Sucrose per gallon.	
						Lb.	Tons.
Badilla	April 10 to 19, 1916. 18½ to 19 months old.	About 63 per cent.	19·9	17·64	88·6	1·923	28·96
B. 6450			20·5	18·27	93·7	1·997	29·67
D. 109			18·3	14·54	79·4	1·558	37·18
B. 1753			17·3	15·15	84·6	1·630	36·22
B. 347			16·8	13·40	79·7	1·430	34·29
D. 3956			18·4	15·10	82·0	1·626	29·41
D. 116			18·8	16·13	85·8	1·746	30·85
B. 156			18·4	15·32	83·2	1·650	30·05

TABLE IV.—HEAVY SOIL:—FIELD "GRU-GRU," BRECHIN CASTLE.

Results from Factory—First mill juice.

CANE.	Date reaped and tested.	JUICE.					Per acre canes.
		Per cent. extracted.	Brix.	Per cent. Sucrose.	Quotient of purity.	Sucrose per gallon.	
						Lb.	Tons.
B. 347 ...	April 26 to May 9, 1916. 18½ to 19 months old,	About 63 per cent.	19·4	16·11	83·0	1·743	26·88
D. 109			20·0	17·59	88·0	1·917	26·59
D. 116			20·2	16·58	82·6	1·797	22·95
B. 6450			20·5	18·27	93·7	1·997	21·41
B. 1753 ...			19·3	16·62	86·1	1·803	23·17
Badilla... ...			21·6	19·32	89·4	2·124	18·39
B. 156			20·3	17·83	87·8	1·946	21·14
D. 3956			20·1	17·26	85·8	1·877	18·82

CARONI ESTATE.

TABLE V.—LIGHT SOIL.—FIELD 124 F, CARONI.

Results from Small Mill.

Field ... ...No. 124 F.—Light soil—Clay loam.
Area planted ...D. 109, D. 116, B. 6450 and Bourbon = 1 acre each: Badilla = 8,712 square feet.
Date planted ...October 17, 1914.
Manures applied...About 12 tons pen manure per acre, 2 cwt. sulphate of ammonia and 1 cwt. superphosphate of lime.

Date tested
(a) January 18, 1916 ... ... 15 months old.
(b) February 22, 1916 ... ... 16 months old.
(c) March 28, 1916 ... ... 17½ months old.

Rainfall
January 1, to 17, 1916 ... ... 3·37 in.
January 18 to February 21, 1916 ... 2·11 ,,
February 22 to March 27, 1916 ... 1·82 ,,

CANE.		JUICE.								PER ACRE.		
					Percentage of							
		Per cent. extracted.	Specific gravity.	Brix.	Sucrose.	Glucose.	Non-Sugar.	Quotient of purity.	Sucrose per gallon.	Canes.	Juice.	Sucrose in juice.
									Lb.	Tons.	Galls.	Tons.
Badilla .	(a)	61·8	1·0824	19·8	17·61	0·98	1·21	88·9	1·906	24·00	3,037	2·84
	(b)	64·4	1·0864	20·7	18·99	0·71	1·00	91·7	2·063			
	(c)	61·5	1·0866	21·2	19·24	0·68	1·28	90·7	2·094			
D. 116 ...	(a)	64·2	1·0621	15·2	11·87	1·64	1·69	78·1	1·261	27·59	3,738	2·64
	(b)	65·7	1·0678	16·5	13·51	1·72	1·27	81 9	1·442			
	(c)	64·9	1·0730	17·7	14·76	1·45	1·49	83·4	1·584			
Bourbon ...	(a)	68·8	1·0587	14·4	10·92	1·92	1·56	75·8	1·156	23·61	3,370	2·47
	(b)	68·3	1·0717	17·4	15·21	1·32	0·87	87·4	1·640			
	(c)	70·3	1·0713	17·3	14·73	1·50	1·07	85·1	1·578			
B. 6450 ...	(a)	68·7	1 0600	14·7	11·35	1·70	1·65	77·2	1·200	23·09	3,253	2·34
	(b)	68·5	1·0674	16·4	13·86	1·32	1·22	84·5	1·479			
	(c)	67·4	1·0717	17·4	15·07	1·12	1·21	86·6	1·615			
D. 109 ...	(a)	66·4	1·0604	14·8	11·05	2·09	1·66	74·7	1·172	27·92	3,875	2·33
	(b)	66·0	1·0652	15·9	12·67	2·08	1·15	79·7	1·350			
	(c)	65·0	1·0630	15·4	12·15	1·92	1·33	78·9	1·231			

The results recorded in Tables V and VI show that with the exception of the Bourbon and the Badilla, none of the varieties were ripe before May when the canes were approximately 18½ months old.

TABLE VI.—LIGHT SOIL.—FIELD 124 F, CARONI.

Results from Factory.—First Mill Juice.

CANE.	Date reaped and tested.	JUICE.						Per acre canes.
				Percentage of				
		Per cent. extracted.	Brix.	Sucrose.	Glucose.	Quotient of purity.	Sucrose per gallon.	
							Lb.	Tons.
Badilla	May 3, 1916—18½ months old.	About 63 per cent.	20·3	17·23	1·00	84·7	1·874	24·00
D. 116			20·0	17·11	0·91	85·3	1·860	27·59
Bourbon			17·7	14·20	1·32	84·2	1·603	23·61
B. 6450			19·2	16·25	1·00	84·4	1·760	23·09
D. 109			18·2	14·77	1·51	80·9	1·587	27·92

EXPERIMENT STATION—ST. AUGUSTINE.

TABLE VII.—LIGHT SOIL.—ST. AUGUSTINE, NURSERY No. 1.

Results from Small Mill.

Soil ...	...Light, Sandy Loam.		
Date planted	...August 21, 1914.		
Manures applied	...About 15 tons pen manure per acre.		
Date tested	(*a*) January 20, 1916	... ...	17 months old.
	(*b*) February 22, 1916	... ...	18 months old.
	(*c*) March 28, 1916	... ...	19 months old.
Rainfall	January 1 to 19, 1916	... ...	2·35 ins.
	January 20 to February 21, 1916	...	2·71 „
	February 22 to March 28, 1916	...	1·76 „

CANE.		Area under Cultivation.	JUICE.								PER ACRE.		
			Per cent. extracted.	Specific gravity.	Brix.	Percentage of			Quotient of purity.	Sucrose per gallon.	Canes.	Juice.	Sucrose in juice.
						Sucrose.	Glucose.	Non-sugar.					
		Sq. ft.								Lb.	Tons.	Gals.	Tons.
B. 1753 ...	(*a*)	6,360	65·5	1·0570	14·0	9·61	2·87	1·52	68·6	1·016			
	(*b*)		65·0	1·0574	14·1	10·30	2·94	0·86	73·0	1·089			
	(*c*)		64·7	1·0674	16·4	13·13	1·92	1·35	80·1	1·401	61·29	8,322	5·40
B. 6308 ...	(*a*)	8,000	69·9	1·0574	14·1	10·44	2·30	1·36	74·0	1·104			
	(*b*)		69·1	1·0583	14·3	11·37	2·00	0·93	79·5	1·203			
	(*c*)		67·6	1·0643	15·7	13·12	1·78	0·80	83·6	1·396	53·15	7,562	4·71
B. 16536 ...	(*a*)	6,360	69·9	1·0523	12·9	8·37	3·07	1·46	64·9	0·881			
	(*b*)		69·5	1·0536	13·2	9·15	2·78	1·27	69·3	0·964			
	(*c*)		69·6	1·0643	15·7	12·38	2·40	0·92	78·8	1·318	50·59	7,411	4·36
B. 6450 ...	(*a*)	6,360	69·8	1·0519	12·8	8·91	2·30	1·59	69·6	0·937			
	(*b*)		69·9	1·0557	13·7	10·51	1·79	1·40	76·7	1·109			
	(*c*)		70·6	1·0630	15·4	12·55	1·78	1·07	81·5	1·334	42·72	6,355	3·72
B. 4934 ...	(*a*)	11,000	65·9	1·0574	14·1	11·18	1·64	1·28	79·3	1·182			
	(*b*)		63·2	1·0660	16·1	14·22	1·25	0·63	88·3	1·516			
	(*c*)		62·5	1·0730	17·7	16·12	0·94	0·64	91·1	1·730	36·54	4,767	3·68
B. 3922 ...	(*a*)	6,360	70·0	1·0531	13·1	9·10	2·70	1·30	69·5	0·958			
	(*b*)		66·4	1·0621	15·2	12·26	2·00	0·94	80·6	1·302			
	(*c*)		68·0	1·0652	15·9	13·01	1·92	0·97	81·8	1·386	40·98	5,860	3·62
B. 6835 ...	(*a*)	8,000	65·9	1·0669	16·3	13·52	1·39	1·39	82·9	1·442			
	(*b*)		63·9	1·0713	17·3	15·56	1·02	0·72	89·9	1·667			
	(*c*)		66·1	1·0819	19·7	18·01	0·72	0·97	91·4	1·948	29·19	3,995	3·47
B. 6388 ...	(*a*)	6,360	70·0	1·0587	14·4	10·53	2·30	1·57	73·1	1·115			
	(*b*)		69·1	1·0630	15·4	12·25	2·17	0·98	79·6	1·302			
	(*c*)		66·8	1·0630	15·4	12·20	1·92	1·28	79·2	1·297	39·86	5,611	3·25
B. 7169 ...	(*a*)	9,000	66·5	1·0561	13·8	10·16	2·19	1·45	73·6	1·073			
	(*b*)		66·2	1·0570	14·0	10·84	1·85	1·31	77·4	1·146			
	(*c*)		65·5	1·0643	15·7	12·73	1·78	1·19	81·1	1·355	37·67	5,193	3·14
B. 3390 ...	(*a*)	9,000	68·9	1·0481	11·9	6·01	3·54	2·35	50·5	0·630			
	(*b*)		66·8	1·0548	13·5	8·69	3·12	1·69	64·4	0·917	43·34	6,192	3·05
	(*c*)		67·5	1·0583	14·3	10·44	2·67	1·19	72·9	1·104			
B. 4578 ...	(*a*)	9,000	71·7	1·0506	12·5	7·54	3·28	1·68	60·3	0·792			
	(*b*)		65·8	1·0643	15·7	11·99	2·50	1·21	76·4	1·276	34·43	5,159	2·61
	(*c*)		71·0	1·0613	15·0	10·70	2·82	1·48	71·3	1·135			
Bourbon...	(*a*)	6,360	69·5	1·0489	12·1	8·00	2·55	1·55	66·1	0·839			
	(*b*)		67·2	1·0626	15·3	12·35	2·08	0·87	80·7	1·312			
	(*c*)		66·0	1·0630	15·4	12·45	1·92	1·03	80·8	1·323	30·99	4,310	2·54

The canes grown in the Board of Agriculture nursery No. 1 gave a large yield of canes per acre but generally the quality of the juice was poor, although the canes were 19 months old when tested on March 28. B. 6835 and B. 4934 come to maturity earlier than the other varieties.

TABLE VIII.—LIGHT SOIL.—ST. AUGUSTINE, NURSERY NO. 2.

Results from Small Mill.

Soil ... ...Light sandy loam.

Date planted ...December 10, 1914.

Manures applied...About 15 tons pen manure per acre.

Date tested ...May 11, 1916 ... ... 17 months old.

Rainfall { April 1 to 30, 1916 ... ... 1·39 in.
{ May 1 to 11, 1916 ... ... 0·29 „

CANE.	Area under cultivation.	JUICE.								PER ACRE.		
		Per cent. extracted.	Specific gravity.	Brix.	Percentage of			Quotient of purity.	Sucrose per gallon.	Canes.	Juice.	Sucrose in juice.
					Sucrose.	Glucose.	Non-Sugar.					
	Sq. ft.								Lb.	Tons.	Galls.	Tons.
B. 6308 ...	5,720	68·3	1·0775	18·7	16·44	1·40	0·86	87·9	1·771	35·98	5,109	4·04
H. 227 ...	2,080	63·2	1·0824	19·8	17·81	0·92	1·07	89·9	1·928	35·34	4,622	3·98
B. 3922 ...	5,720	69·1	1·0761	18·4	15·89	1·58	0·93	86·3	1·710	34·74	4,997	3·81
B. 6835 ...	11,440	66·5	1·0891	21·3	19·66	0·56	1·08	92·3	2·141	28·13	3,847	3·68
B. 7169 ...	5,720	69·0	1·0717	17·4	13·22	2·33	1·85	76·0	1·417	38·46	5,547	3·51
B. 6450 ...	5,720	69·2	1·0735	17·8	15·18	1·18	1·44	85·3	1·629	32·65	4,714	3·43
B. 6388 ...	11,440	70·1	1·0783	18·9	16·23	1·69	0·98	85·9	1·750	29·98	4,366	3·41
B. 4934 ...	5,720	62·8	1·0806	19·4	17·79	0·84	0·77	91·7	1·922	29·51	3,841	3·29
B. 3390 ...	5,720	68·2	1·0753	18·2	15·16	1·88	1·16	83·3	1·630	30·84	4,381	3·19
(B.N.H. 02) (1)	2,860	66·3	1·0783	18·9	17·10	0·98	0·82	90·5	1·844	27·41	3,775	3·11
H. 146 ...	5,200	64·7	1·0788	19·0	16·47	1·40	1·13	86·7	1·777	28·69	3,854	3·06
Bourbon ...	5,720	70·4	1·0700	17·0	14·21	1·85	0·94	83·6	1·520	28·46	4,194	2·34
B. 4578 ...	5,720	69·4	1·0700	17·0	12·56	2·45	1·99	73·9	1·344	32·17	4,674	2·80
H. 27 ...	5,720	67·5	1·0757	18·3	14·36	1·96	1·38	81·7	1·609	27·03	3,799	2·73
(B.N.H. 02) (5)	2,860	62·4	1·0797	19·2	16·79	1·48	0·93	87·4	1·813	17·70	2,291	1·85

A comparison of the results obtained for the same varieties, planted in the Board of Agriculture nurseries (tables VII and VIII) is interesting.

The results are tabulated below:–

Board of Agriculture Nursery No. 1.	*Board of Agriculture Nursery No. 2.*
Canes planted, August 21, 1914.	Canes planted, December 10, 1914.
Manures applied, about 15 tons pen manure per acre.	Manures applied, about 15 tons pen manure per acre.
Reaped and tested, March 28, 1916—19 months old.	Reaped and tested, May 11, 1916—17 months old.

Cane.	Sucrose per cent.	Per acre.		Sucrose per cent.	Per acre.	
		Canes.	Sucrose.		Canes.	Sucrose.
		Tons.	Tons.		Tons.	Tons.
B. 6308 ...	13·12	53·15	4·71	16·44	35·98	4·04
B. 6450 ...	12·55	42·72	3·72	15·18	32·65	3·43
B. 4934 ...	16·12	36·54	3·68	17·79	29·51	3·29
B. 3922 ...	13·01	40·98	3·62	15·89	34·74	3·81
B. 6835 ...	18·01	29·19	3·47	19·66	28·13	3·68
B. 6388 ...	12·25	39·86	3·25	16·23	29·98	3·41
B. 7169 ...	12·73	37·67	3·14	13·22	38·46	3·51
B. 3390 ...	10·44	43·34	3·05	15·16	30·84	3·19
B. 4578 ...	11·99	34·43	2·61	12·56	32·17	2·80
Bourbon ...	12·45	30·99	2·54	14·21	28·46	2·84

Although the canes from Nursery No. 1 were 19 months and those from Nursery No. 2 were 17 months old when reaped in March and May respectively, the juice from the latter was much superior to that of the former for each variety respectively. From this it would appear that the time at which the canes are reaped has a greater influence on the quality of the juice than the age of the canes.

The small plots at St. Augustine Experiment Station planted with the Hawaii varieties in December 1913, were reaped as first ratoons in April 1916, being approximately eleven months old. The results are given in table IX. Table X gives the results of these same canes as plants and first ratoons and the average results for the two years are also recorded in this table.

TABLE IX.—HAWAIIAN VARIETIES.—FIRST RATOONS.

CANE.	Area under Cultivation.	JUICE.								PER ACRE.		
		Per cent. extracted.	Specific gravity.	Brix.	Percentage of			Quotient of purity.	Sucrose per gallon.	Canes.	Juice.	Sucrose in juice.
					Sucrose.	Glucose.	Non-sugar.					
	Sq. ft.								Lb.	Tons.	Gals.	Tons.
H. ? ...	2,640	64·0	1·0722	17·5	15·26	1·14	1·10	87·2	1·636	23·10	3,089	2·26
H. 27 ...	1,100	64·9	1·0665	16·2	13·43	1·40	1·37	82·9	1·432	19·30	2,631	1·68
H. 227 ...	1,100	61·6	1·0652	15·9	13·25	1·40	1·25	83·3	1·411	16·33	2,115	1·33
H. 146 ...	3,520	67·0	1·0548	13·5	10·07	2·04	1·39	74·6	1·062	19·18	2,729	1·29

TABLE X.—HAWAIIAN VARIETIES.—PLANT CANES AND FIRST RATOONS.

CANE.	SUCROSE IN JUICE.—TONS PER ACRE.		
	Plant Canes 17 months old.	1st Ratoons 11 months old.	Average for 2 years.
H. ?	3·18	2·26	2·72
H. 27	2·64	1·68	2·16
H. 146	2·38	1·29	1·83
H. 227	1·95	1·33	1·64

ST. AUGUSTINE ESTATE.

TABLE XI.—LIGHT SOIL, ST. AUGUSTINE.

Results from Small Mill.

Field ...	...Nos. 6 and 3.—Light soil—Sandy loam.		
Date planted	...No. 6, October 15 and No. 3, October 29, 1914.		
Manures applied	...About 20 tons pen manure per acre.		
Date tested	(*a*) January 27, 1916...	... ...	About 15 months old.
	(*b*) March 1, 1916 ...	... ...	About 16 months old.
	(*c*) April 26, 1916 ...	... ...	About 18 months old.
Rainfall	January 1 to 26, 1916	... ...	2·66 in.
	January 26 to February 29, 1916	...	2·40 „
	March 1 to April 25, 1916	... ...	3·15 „

CANE.		Area under cultivation.	JUICE.								PER ACRE.		
			Per cent. extracted.	Specific gravity.	Brix.	Percentage of			Quotient of purity.	Sucrose per Gallon.	Canes.	Juice.	Sucrose in juice.
						Sucrose.	Glucose.	Non-Sugar.					
		Sq. ft.								Lb.	Tons.	Galls.	Tons.
B. 208	(*a*)	8,998	66·8	1·0613	15·0	12·12	1·77	1·11	80·8	1·286			
	(*b*)		65·7	1·0656	16·0	13·15	1·71	1·14	82·2	1·401			
	(*c*)		64·6	1·0783	18·9	17·10	1·11	0·69	90·5	1·844	41·75	5,620	4·63
B. 156	(*a*)	48,720	68·8	1·0506	12·5	8·13	2·70	1·67	65·0	0·854			
	(*b*)		66·3	1·0674	16·4	13·03	2·27	1·10	79·4	1·391			
	(*c*)		65·8	1·0753	18·2	15·16	1·88	1·16	83·3	1·630	46·23	6,337	4·61
D. 145	(*a*)	27,750	66·9	1·0540	13·3	9·69	2·30	1·31	72·8	1·021			
	(*b*)		65·2	1·0596	14·6	11·46	2·08	1·06	78·5	1·214			
	(*c*)		63·9	1·0730	17·7	15·54	1·11	1·05	87·8	1·667	45·70	6,096	4·54
B. 7169	(*a*)	9,196	68·7	1·0527	13·0	8·81	2·42	1·77	67·8	0·927			
	(*b*)		65·6	1·0643	15·7	12·43	2·17	1·10	79·2	1·323			
	(*c*)		65·7	1·0713	17·3	14·78	1·48	1·04	85·4	1·583	46·60	6,401	4 52
B. 1753	(*a*)	10,080	66·5	1·0574	14·1	10·44	2·55	1·11	74·0	1·104			
	(*b*)		65·3	1·0600	14·7	10·96	2·38	1·36	74·5	1·162			
	(*c*)		61·9	1·0788	19·0	15·84	1·81	1·35	83·4	1·709	41·00	5,270	4·02
D. 109	(*a*)	8,646	68·1	1·0540	13·3	9·09	2·55	1·66	68·3	0·958			
	(*b*)		68·2	1·0536	13·2	8·80	2·63	1·77	66·7	0·927			
	(*c*)		66·1	1·0601	16·8	13·06	2·33	1·41	77·7	1·396	45·97	6,366	3·97
B. 6450	(*a*)	9,042	70·7	1·0485	12·0	7·80	2·42	1·78	65·0	0·818			
	(*b*)		69·2	1·0604	14·8	11·40	1·85	1·55	77·0	1·209			
	(*c*)		68·7	1·0691	16·8	14·03	1·40	1·37	83·5	1·500	40·65	5,851	3·92
T. 75	(*a*)	9,306	69·1	1·0493	12·2	6·90	3·07	2·23	56·5	0·724			
	(*b*)		68·5	1·0531	13·1	8·21	2·94	1·95	62·7	0·864			
	(*c*)		67·1	1·0709	17·2	13·96	2·13	1·11	81·2	5·495	41·72	5,855	3·91
D. 116	(*a*)	17,776	68·7	1·0472	11·7	6·96	3·07	1·67	59·5	0·729			
	(*b*)		67·3	1·0527	13·0	7·97	3·33	1·70	61·3	0·839			
	(*c*)		67·2	1·0704	17·1	13·77	2·23	1·10	80·5	1·474	41·14	5,785	3·81
D. 4397	(*a*)	9,966	69·4	1·0553	13·6	9·87	3·07	0·66	72·6	1·041			
	(*b*)		69·5	1·0583	14·3	10·63	2·27	1·40	74·3	1·125			
	(*c*)		65·5	1·0722	17·5	14·58	1·75	1·17	83·3	1·563	39·88	5,457	3·81

TABLE XI.—ST. AUGUSTINE ESTATE.—FIELDS NOS. 6 AND 3. LIGHT SOIL.—*Continued.*

CANE.		Area under cultivation.	JUICE.								PER ACRE.		
						Percentage of							
			Per cent. extracted.	Specific gravity.	Brix.	Sucrose.	Glucose.	Non-Sugar.	Quotient of purity.	Sucrose per gallon.	Canes.	Juice.	Sucrose in juice.
		Sq. ft.								Lb.	Tons.	Galls.	Tons.
Badilla	(a)	118,645	64·4	1·0643	15·7	13·06	1·48	1·16	83·2	1·390			
	(b)		64·2	1·0756	16·0	13·30	1·43	1·27	83·1	1·417			
	(c)		63·6	1·0730	17·7	15·54	1·06	1·10	87·8	1·667	37·22	4,942	3·68
D. 3956	(a)	9,878	69·8	1·0527	13·0	8·36	3·54	1·10	64·3	0·889			
	(b)		68·1	1·0678	16·5	12·68	2·78	1·04	76·8	1·354			
	(c)		67·1	1·0709	17·2	13·62	2·45	1·13	79·2	1·458	39·41	5,531	3·60
B. 3922	(a)	9,746	68·6	1·0566	13·9	10·35	2·30	1·25	74·5	1·093			
	(b)		67·7	1·0596	14·6	11·11	2·27	1·22	76·1	1·282			
	(c)		64·0	1·0717	17·4	15·12	1·58	0·70	86·9	1·620	35·59	4,394	3·54
B. 347	(a)	10,516	69·5	1·0506	12·5	8·88	2·19	1·43	71·0	0·933			
	(b)		68·6	1·0630	15·4	11·71	2·17	1·52	76·0	1·245			
	(c)		67·0	1·0775	18·7	15·62	1·81	1·27	83·5	1·683	33·09	7,609	3·46
B. 16536	(a)	10,318	68·9	1·0523	12·9	8·42	2·70	1·78	65·3	0·886			
	(b)		68·5	1·0621	15·2	11·38	2·50	1·32	74·9	1·209			
	(c)		68·4	1·0713	17·3	13·47	1·96	1·87	77·9	1·443	37·47	5,359	3·45
D. 504	(a)	37,342	67·0	1·0583	14·3	10·39	2·70	1·21	72·6	1·099			
	(b)		65·1	1·0656	16·0	13·20	2·00	0·80	82·5	1·406			
	(c)		62·7	1·0669	16·3	13·43	1 63	1·24	82·4	1·433	40·84	5,376	3·44
D. 366	(a)	9,922	71·0	1·0531	13·1	8·61	2·55	1·94	65·7	0·907			
	(b)		69·2	1·0639	15·6	11·75	2·27	1·58	75·3	1·250			
	(c)		69·6	1·0722	17·5	15·11	1·58	0·81	86·3	1·620	31·88	4,635	3·35
B. 6308	(a)	4,997	63·0	1·0591	14·5	11·07	2·19	1·24	76·3	1·172			
	(b)		67·8	1·0643	15·7	12·48	2·00	1·22	79·5	1·328			
	(c)		67·0	1·0779	18·8	15·96	1·52	1·32	84·9	1·720	29·96	4,171	3·20
T. 202	(a)	9,812	67·6	1·0617	15·1	11·78	2·30	1·02	78·0	1·251			
	(b)		67·2	1·0678	16·5	13·66	1·72	1·12	82·3	1·459			
	(c)		63·5	1·0766	18·5	15·63	1·63	1·24	84·5	1·683	31·57	4,171	3·13
B. 6835	(a)	9,152	67·3	1·0609	14·9	12·28	1·48	1·14	82·4	1·303			
	(b)		68·6	1·0678	16·5	14·10	1·16	1·24	85·4	1·505			
	(c)		65·0	1·0775	18·7	17·07	0·72	0·91	91·3	1·839	28·08	3,794	3·11
D. 2468	(a)	10,010	67·8	1·0660	14·7	11·16	2·30	1·24	75·9	1·183			
	(b)		67·5	1·0647	15·8	12·33	2·17	1·30	78·0	1·313			
	(c)		69·1	1·0722	17·5	13·41	2·04	2·05	76·6	1·438	32·58	4,703	3·02
T. 39	(a)	10,296	70·1	1·0561	13·8	9·96	2·42	1·42	72·2	1·052			
	(b)		70·1	1·0639	15·6	12·29	2·17	1·14	78·8	1·307			
	(c)		68·6	1·0753	18·2	14·78	1·75	1·67	81·2	1·589	28·87	4,126	2·93

TABLE XI.—ST. AUGUSTINE ESTATE.—FIELDS NOS. 6 AND 3. LIGHT SOIL.—*Continued.*

Cane.		Area under cultivation.	Juice.								Per Acre.		
			Per cent. extracted.	Specific gravity.	Brix.	Percentage of			Quotient of purity.	Sucrose per gallon.	Canes.	Juice.	Sucrose in juice.
						Sucrose.	Glucose.	Non-Sugar.					
		Sq. ft.								Lb.	Tons.	Galls.	Tons.
B. 6388	(a)	11,145	70·3	1·0497	12·3	8·04	2·42	1·84	65·4	0·844			
	(b)		70·1	1·0630	15·4	11·96	2·08	1·36	77·7	1·271			
	(c)		67·4	1·0770	18·6	15·79	1·72	1·09	84·9	1·700	27·50	3,855	2·92
B. 3859	(a)	8,734	67·4	1·0497	12·3	8·09	2·42	1·79	65·8	0·849			
	(b)		66·2	1·0519	12·8	8·27	2·94	1·59	64·6	0·870			
	(c)		65·7	1·0613	15·0	11·34	1·96	1·70	75·6	1·203	39·03	5,412	2·91
B. 3412	(a)	9,086	71·8	1·0506	12·5	7·29	3·83	1·38	58·3	0·766			
	(b)		66·8	1·0578	14·2	9·06	3·57	1·57	63·8	0·958			
	(c)		67·6	1·0674	16·4	11·66	2·58	2·16	71·1	1·244	36·31	5,151	2·86
B. 4578	(a)	9,702	71·3	1·0489	12·1	7·75	2·42	1·93	64·0	0·813			
	(b)		68·0	1·0630	15·4	12·30	1·85	1·25	79·9	1·307			
	(c)		68·3	1·0735	17·8	13·83	1·81	2·16	78·7	1·485	30·19	4 302	2·85
D. 464	(a)	10,208	64·2	1·0548	13·5	9·38	2·55	1·57	69·5	0·988			
	(b)		64·4	1·0665	16·2	12·94	2·17	1·09	79·9	1·380			
	(c)		64·4	1·0700	17·0	13·88	1·88	1·24	81·6	1·485	31·79	4,286	2·84
B. 4934	(a)	10,472	67·6	1·0485	12·0	8·65	1·92	1·43	72·1	0·907			
	(b)		65·2	1·0591	14·5	11·56	1·92	1·02	79·7	1·224			
	(c)		65·3	1·0766	18·5	16·45	1·14	0·91	88·9	1·771	26·05	3,539	2·80
D. 115	(a)	8,954	63·9	1·0510	12·6	8·33	2·70	1·57	66·1	0·875			
	(b)		64·1	1·0536	13·2	8·95	2·63	1·62	67·8	0·943			
	(c)		63·3	1·0739	17·9	15·04	1·96	0·90	84·0	1·615	27·24	3,597	2·59
D. 4395	(a)	10,252	70·2	1·0527	13·0	8·61	2·70	1·69	66·2	0·906			
	(b)		69·4	1·0600	14·7	10·62	2·63	1·45	72·2	1·126			
	(c)		68·7	1·0713	17·3	12·79	2·45	2·06	73·9	1·370	29·42	4,226	2·58
Bourbon	(a)	31,212	69·8	1·0591	14·5	10·82	2·30	1·38	74·6	1·146			
	(b)		70·4	1·0630	15·4	11·96	2·27	1·17	77·7	1·271			
	(c)		63·1	1·0739	17·9	15·18	1·58	1·14	84·8	1·630	26·20	3,448	2·51
B. 3390	(a)	9,350	67·9	1·0544	13·4	9·04	2·55	1·81	67·5	0·953			
	(b)		66·5	1·0493	12·2	7·50	2·94	1·76	61·5	0·787			
	(c)		67·3	1·0652	15·9	11·98	2·33	1·59	75·3	1·276	31·15	4,408	2·51
B. 16832	(a)	9,240	71·5	1·0481	11·9	5·77	3·54	2·59	48·5	0·605			
	(b)		69·6	1·0451	11·2	6·33	3·33	1·54	56·5	0·661			
	(c)		64·3	1·0527	13·0	8·81	3·07	1·12	67·8	0·927	31·76	4,345	1·80

TABLE XII.—LIGHT SOIL.—ST. AUGUSTINE.

Results from Small Mill.

Field ... ...No. 3.—Light soil. Sandy loam.
Date planted ...May 15, 1915.
Manures applied...About 20 tons pen manure per acre.
Date tested ...May 16, 1916. 12 months old.

CANE.	Area under cultivation.	JUICE.								PER ACRE		
		Per cent. extracted.	Specific gravity.	Brix.	Percentage of			Quotient of purity.	Sucrose per gallon.	Canes.	Juice.	Sucrose in juice.
					Sucrose.	Glucose.	Non-Sugar.					
	Sq. ft.								Lb.	Tons.	Galls.	Tons.
D. 504 ...	21,217	64·0	1·0783	18·9	15·75	1·96	1·19	83·3	1·698	30·18	4,012	3·04
D. 109 ...	22,220	68·2	1·0674	16·4	12·56	2·66	1·18	76·6	1·341	35·26	5,046	3·02
D. 145 ...	22,352	66·7	1·0682	16 6	13·65	1·88	1·07	82·2	1·458	32·54	4,551	2·96
D. 2468 ...	22,550	64·2	1·0739	18·2	15·55	1·51	1·14	85·4	1·672	27·79	3,721	2·78
D. 116 ...	21,692	66·7	1·0726	17·6	14·57	1·69	1·34	82·8	1·563	24·75	3,447	2 40
B. 1753 ...	21,978	64·2	1·0739	17·9	15·09	1·81	1·00	84·3	1·620	23·91	3,202	2·31
B. 147 ...	21,824	69·4	1·0656	16·0	12·47	2·33	1·80	77·9	1·329	21·43	3,126	1·35
B. 6835 ...	21,428	66·5	1·0770	18·6	16·44	1·09	1·07	88·4	1·770	18·39	2,267	1·79
B. 3922 ...	10,780	67·7	1·0695	16 9	14·12	1·75	1·03	83·5	1·510	17·88	2,535	1·71
B. 4934 ...	6,734	65·6	1·0713	17·3	15·22	1·19	0·89	88·0	1·630	16·09	2,207	1·60

TABLE XIII.—BADILLA CANE.—ST. AUGUSTINE.

The results of the Badilla third ratoons in Field 5 at St. Augustine estate are recorded below :—

Area planted ...46,282 square feet.
Date planted ...November, 1911.
Manures applied...20 tons pen manure per acre to plant canes.

Date reaped	Plant Canes	...April 1913, 17 months old.
	First ratoons	...April 1914, 12 ,, ,,
	Second ,,	...April 1915, 12 ,, ,,
	Third ,,	...Feby. 1916, 10 ,, ,,

DESCRIPTION.	JUICE.								PER ACRE.		
	Per cent. extracted.	Specific gravity.	Brix.	Percentage of			Quotient of purity.	Sucrose per gallon.	Canes.	Juice.	Sucrose in juice.
				Sucrose.	Glucose.	Non-sugar.					
								Lb.	Tons.	Gals.	Tons.
Plants	66·8	1·0866	21·2	18·59	1·37	1·24	87·7	2·024	30·94	4,253	3·84
1st. Ratoons ...	64·1	1·0895	21·4	18 84	1·22	1·34	88·0	2·053	30·65	4,039	3·70
2nd. Ratoons ...	63·2	1·0866	21·2	18·90	1·28	1·02	89·6	2·057	21·01	2,732	2·51
3rd. Ratoons ...	66·8	1·0837	20·1	18·03	1·31	0·76	89·7	1·954	20·19	2,788	2·43
Average for 4 years	...	...	...	...	...	...	...	...	25·70	...	3·12

SUCROSE CONTENTS OF TOP, CENTRE, AND BOTTOM PORTION OF CANES.

The following experiment was made on April 10, with a view of testing the relative value of the top, centre and bottom portion of canes for manufacturing sugar.

A sample of twelve apparently ripe canes of B. 156 were cut and topped in the usual manner (when canes are cut for the factory). The upper 10 or 12 inches, containing three or four joints of cane, was cut off, the remainder of the cane being cut into two equal portions.

Each portion was passed through the mill separately and the juice analysed with the following results:—

Description.	Juice.					
	Per cent. extracted.	Brix.	Percentage of		Quotient of purity.	Sucrose per gallon.
			Sucrose.	Glucose.		
						Lb.
1. Tops ...	54·6	11·5	7·52	1·75	65·4	0·787
2. Centre ...	65·2	19·4	17·93	0·67	92·4	1·937
3. Bottoms ...	67·4	19·8	17·76	0·98	89·7	1·922

RICE.

ENCOURAGEMENT OF RICE CULTIVATION.

The following is the report of a Special Committee of the Board of Agriculture appointed to frame proposals to secure the encouragement of the rice industry. It was adopted by the Board on February 21, 1917. At the subsequent meeting in March the programme was enlarged to include a third competition amongst rice growers at Cedros, and the importation of a further two tons of seed paddy from British Guiana was sanctioned making four tons in all. The co-operation of the Naparima and Fyzabad District Agricultural Societies has been invited. It is proposed also, when desirable to distribute the seed to be paid for in kind when the crop is gathered in order to assist necessitous small cultivators:

The Committee consisting of Hon. Sir Norman Lamont, Bart., (Chairman), Mr. A. B. Carr, and W. G. Freeman, met on January 8 and 17, 1917. Evidence was taken from Hon. Major de Bossière, (Protector of Immigrants) Mr. J. P. Farnum, Mr. Edgar Tripp (Secretary of the Agricultural Society), Mr. J. de Verteuil (Superintendent of Field Experiments) and Mr. C. M. Roach (Agricultural Inspector).

The Committee expresses its appreciation of Mr. Farnum's courtesy in giving it the benefit of his extensive knowledge of the subject.

Before proceeding to frame definite recommendations, the Committee discussed the general features of the rice industry, and it will be convenient to summarize those which are pertinent to the matters under reference.

POSITION OF THE INDUSTRY.

The present crop of paddy (unhusked rice) may be roughly estimated at 40,000 bags (of 160lb.) grown on some 5,000 acres. Swamp rice is principally grown, the cultivation being carried on by small proprietors and tenants, mainly East Indians. The principal areas of production are in the Oropuche, Caroni and Chaguanas districts, small patches exist in other localities. Hill or upland rice is also cultivated on a very limited scale in many parts of the Colony. A considerable proportion of the crop is hulled in the houses of the growers in simple pounding mills, and the surplus sold to the rice mills, of which there are three at work, situated at Port-of-Spain, St. Augustine, and Chaguanas. The total capacity of these mills may be stated at 100 bags of paddy per day. These mills are capable of dealing with more than double the present rice crop of the colony. The yield of cleaned rice is approximately 60 per cent. of the weight of the paddy.

Mr. Farnum put forward the following sliding scale of prices which the Port-of-Spain mill would be prepared to pay for paddy, delivered at any railway station when the market value of rice is as shown in the first column:

When Rice is per bag of 160 lb.	*Price of Paddy per bag of 160 lb.*
$4.00 (16s. 8d.)	$1.56 (6s. 6d.)
4.50 (18s. 10d.)	1.80 (7s. 6d.)
5.00 (£1 0s. 10d.)	1.86 (7s. 9d.)
5.50 (£1 2s. 11d.)	2.16 (9s. 0d.)
6.00 (£1 5s. 0d.)	2.34 (9s. 9d.)
6.50 (£1 7s. 1d.)	2.52 (10s. 6d.)
7.00 (£1 9s. 2d.)	2.76 (11s. 6d.)
7.50 (£1 11s. 3d.)	3.00 (12s. 6d.)

The Committee also discussed the results obtained from the introduced varieties, particularly with regard to the suggested importation of seed paddy from India. Trials made so far with Indian varieties have not given good results, the yield has been poor and the grain not equal to that already grown here. On the other hand, some of the British Guiana varieties have borne well, and also proved very satisfactory when milled.

RECOMMENDATIONS.

The Committee recommends :—

1.—PRIZE COMPETITIONS.

(*a.*) That prizes be offered by the Board during 1917 for the good cultivation of rice in the following districts: Oropuche and Caroni (including Chaguanas, Charlieville and Bejucal).

(*b.*) That three prizes be offered for the November crop in each district of the value of $20, $10 and $5, making $70 in all, payable in January, 1918.

(*c.*) That half an acre under rice be the minimum area to quality for entry, at any rate, in the Oropuche district.

(*d.*) That the points to be taken into consideration in judging be yield per acre (to be tested by reaping a small area), quality of rice, and method of cultivation.

(*e.*) That in the Oropuche district the co-operation of the Naparima and Fyzabad District Agricultural Societies be invited for the carrying out of the competition.

2.—INTRODUCTION AND DISTRIBUTION OF SEED.

(*a.*) That two tons of a standard British Guiana rice be imported by the Board at an estimated cost of about $80. Mr. Farnum consented to undertake this if requested. The Government to be asked to allow it entry free of import duty.

(*b.*) That particulars be obtained with the seed regarding the depth of water in which the variety grows, the time it takes to mature, and any particulars about soil requirements, &c.

(*c.*) That the imported seed be sold to cultivators at the same price as that of local seed rice on condition that they enter the competition.

(*d.*) That the District Agricultural Societies mentioned above be asked to assist in the work of distribution.

(*e.*) That the Department of Agriculture continue its trials of imported rices, particularly of British Guiana, India and Louisiana varieties but that no general distribution of the seed of such varieties be made until it has been shown that they are suited to local conditions and give better returns than those already grown.

3.—CO-OPERATIVE MILLS.

As there are enough rice mills to deal with more than double the crop, there appears no present necessity to recommend the establishment of a co-operative mill with a direct Government subsidy. Steps should however be taken to acquaint rice growers with the mode of working such enterprises as co-operative rice mills which future development of the industry may render desirable. These could readily be established through the medium of the Agricultural Credit Societies Ordinance.

4.—IRRIGATION.

That in view of the greatly increased returns and the greater certainty of crops under a properly controlled water system, steps be taken to ascertain the suitability of certain areas, *e.g.* Caroni, for an irrigation scheme, and the cost of the same. That if such a scheme proved feasible, Government assistance might be afforded by the guarantee of interest on the capital expenditure which would be required.

This proposal is recommended to the favourable consideration of the Government in view of the attraction which would be afforded to East Indians to settle in the Colony, and of the urgency of increasing the local food supply.

Another argument in favour of this proposal is that by means of an irrigation scheme areas of land would be reclaimed and developed which are at present not only unproductive but also injurious to health.

5.—CROWN LANDS.

That the Government be asked to throw open for rice cultivation any suitable available lands.

NORMAN LAMONT,
Chairman.

W. G. FREEMAN.

A. B. CARR.

January 17, 1917.

CASSAVA.

CASSAVA EXPERIMENTS.

By Joseph de Verteuil, F.C.S.,
Superintendent of Field Experiments.

Experiments in the cultivation of cassava were started in May, 1915 with the object of ascertaining:—

1. The best local varieties.
2. The best planting distances.
3. The best part of the sticks for planting.
4. The best method of planting, *i.e.* on the flat, on banks or in forked holes.
5. Suitability of planting with other crops.

All of the plots were planted between May 18 to 28, 1915 and they were reaped between August 18 to 30, 1916 when about 15 months old.

Local varieties and planting distances.—**Eleven varieties were planted at distances of 3 ft. x 3 ft. and 4 ft. x 4 ft. respectively. Two of these varieties were also planted at 2½ ft. x 2½ ft. and 5 ft. x 5 ft. The results obtained are given below:—**

Variety.	Distance planted.	Yield per acre.	Average yield per acre.
		Tons.	Tons.
Manioc Sellier	3 ft. x 3 ft.	9·74	10·16
	4 ,, x 4 ,,	10·59	
Maman l'Enfant	3 ft. x 3 ft.	7·18	6·52
	4 ,, x 4 ,,	5·86	
Turkey Claw	2½ ft. x 2½ ft.	6·00	5·54
	3 ,, x 3 ,,	5·90	
	4 ,, x 4 ,,	3·15	
	5 ,, x 5 ,,	7·13	
Parasol	3 ft. x 3 ft.	6·16	5·25
	4 ,, x 4 ,,	4·34	

Variety.	Distance planted.	Yield per acre.	Average yield per acre.
		Tons.	Tons.
Mata Hotel	2½ ft. x 2½ ft.	4·17	4·48
	3 ,, x 3 ,,	5·02	
	4 ,, x 4 ,,	4·26	
Manioc Divin	3 ,, x 3 ,,	5·10	4·37
	4 ,, x 4 ,,	3·65	
Black Stick	3 ,, x 3 ,,	4·27	4·14
	4 ,, x 4 ,,	4·01	
Manioc Bonic	3 ,, x 3 ,,	4·25	3·93
	4 ,, x 4 ,,	4·23	
	5 ,, x 5 ,,	3·32	
Manioc Blanc	3 ,, x 3 ,,	3·63	3·66
	4 ,, x 4 ,,	3·70	
Manioc Bredin	3 ,, x 3 ,,	3·63	3·53
	4 ,, x 4 ,,	3·43	
Mata Lotera	3 ,, x 3 ,,	1.52	2·62
	4 ,, x 4 ,,	3·73	

From the results recorded above, it will be seen that only four varieties have given an average yield of over 5 tons of roots per acre viz: Manioc Sellier, Maman l'Enfant, Turkey Claw and Parasol. With the exception of Manioc Sellier a better yield was obtained when planted 3 ft. x 3 ft. than at a distance of 4 ft. x 4 ft. apart.

Selection of plants.—Sticks were taken as is usually done for obtaining plants. One or two plants were then cut off from either end according to the length of the sticks—these would be the top and bottom plants respectively—the remaining portion being called the middle or centre plants.

This experiment was made with three varieties all the sticks being planted at the same distance viz:—3 ft. x 3 ft. In each case the highest yield was obtained from the centre plants as shown below, with two of the varieties the bottom plants come next and with two of the varieties the tops have given the lowest yield. It would therefore appear that plants grown from the older and younger portion of a stick give a smaller yield than plants grown from the centre portions and possibly a higher yield may be obtained by a better selection of plants.

Description.	Distance planted.	Turkey Claw.	Manioc Divin.	Mata Hotel.
Tops	3 ft. x 3 ft.	4.84 tons	4·21 tons	3·53 tons
Bottoms	3 ft. x 3 ft.	6·64 ,,	3·65 ,,	4·18 ,,
Centre	3 ft. x 3 ft.	6·68 ,,	5·48 ,,	5·12 ,,

Planting methods.—Two varieties were planted at distances of 4 ft. x 4 ft. (*a*) on the flat (*b*) in forked holes 2 feet square (*c*) on banks and three varieties on banks 5 ft. x 3 ft. The results obtained are as follows :—

Description.	Distance planted.	Manioc Sellier.	Maman l'Enfant.	Bredin.
On flat	4 ft. x 4 ft.	10·59 tons	5·86 tons	3·43 tons
In holes	4 ft. x 4 ft.	9·59 ,,	5·02 ,,	—
On banks	4 ft. x 4 ft.	8·42 ,,	6·23 ,,	—
On banks	5 ft. x 3 ft.	9·90 ,,	5·10 ,,	3·24 ,,

The results recorded above show that no advantage has been derived from planting in holes or on banks. A substantial increase in the yield would be required to pay for the extra cost of holing and banking.

Planting with other crops.—Cassava was also grown with pigeon peas and cotton, but the result was a failure. Not only the yield of the cassava was poor but the other crops did not thrive.

PLANT DISEASES AND PESTS.

NOTES ON THE MOTH AUTOMERIS JANUS.

By The Hon'ble Sir Norman Lamont, Bart.

The following is an account of an interesting exhibit made by the author at the meeting of the Board of Agriculture in March 1916.—(Ed.):—

Fig. 2 shows a specimen of the larva of one of our largest and most beautiful moths *Automeris janus*: in life it is of a bright green colour, slightly marked with pink. It is found commonly in Trinidad in the month of February, on immortel and cacao trees. In confinement it eats the leaves of either cacao or Bois immortel (*Erythrina umbrosa* and *E. velutina*), but seems to prefer those of the cacao. In the natural state, however,—at any rate when full grown—it is found more frequently on Bois immortel. The probable reason of this is that the rough bark of the immortel suits the larva better than the smoother bark of the cacao for spinning its cocoon upon. Seeing how large the insect is, how widely distributed, and also how it feeds on both cacao and immortel, it may be wondered why it is not a more serious pest in the island. The explanation is that it is kept in check by a parasite. Out of twenty-four of these larvæ reared in confinement only one succeeded in completing its transformation into the perfect insect. All the others had been attacked by a fly. Their pupa cases were packed full of the pupæ of this particular fly. This instance of parasitism is interesting, first because this caterpillar, with its long, rough, and irritating spines would seem to be a most unattractive and difficult place for any fly to deposit her eggs in. How does the female fly deposit her eggs there? This requires further study. In the next place, it is interesting because the pupæ of both moth and fly are so large that one can see exceedingly well the working of this form of parasitisation. In many other instances—with the froghopper and its parasites, for example—both host and parasite are so small that a microscope or at least a powerful lens has to be used in order that the student may see exactly what is happening. Figure 3 shows the pupa case of *Automeris janus* full of the pupæ of the fly which had parasitised it. I do not know whether this fly has any bad qualities, as a disseminator of disease, or otherwise, which may detract from its good work.

NOTE ON THE PARASITE OF AUTOMERIS JANUS.

By F. W. Urich, Entomologist Board of Agriculture.

The parasite reared by Sir Norman Lamont, from the pupæ of *Automeris janus* belongs to the *Tachinidæ* a group of flies the larvæ of which devour their victims. The *Tachinidæ* attack different orders of insects but they are most useful in keeping caterpillars in check. Each species as a rule is confined to a special host. The adult flies are not very conspicuous, being mostly grey or black, but they can be recognized by the numerous spines on the abdomen (*see* fig. 4). They are prolific, some species laying eggs by the thousand. Townsend* who studied their reproductive habits mentions five different styles in which the eggs are deposited viz: (1) Host oviposition, eggs being placed on the caterpillars' skin and the maggots penetrating into the body on hatching. (2) Leaf oviposition—eggs placed on leaves that are eaten by the caterpillars. (3) Supracutaneous host larviposition—living maggots being laid on the skin of the caterpillar. (4) Subcutaneous host larviposition—living maggots are introduced within the skin of the caterpillar. (5) Leaf larviposition whereby the living maggot is stuck on some part of the leaf or stem of the food plant and hooks itself on to a passing caterpillar. The above observations were made on northern species, but no doubt the Trinidad *Tachinidæ* may have similar habits.

The parasite from *Automeris janus* has been determined, through the kindness of Dr. L. O. Howard Chief of the U. S. Bureau of Entomology, as *Willistonia esuriens* (*see* fig. 4). The head and body of the fly measure together 9/16 of an inch and the expanse of the wings from tip to tip equal to 1⅛ inches more or less. The thorax is grayish black, the abdomen black, the posterior end and the ring near it pale yellow. The bristles are black. The wings are of a smoky colour. The maggots live inside of the caterpillar and form their pupæ in the pupal covering of their host. From one pupa, which measured about 2 inches, nine flies issued.

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* A record of results from rearings and dissections of Tachinidæ. *Tech. Series No. 12 Part VI. U. S. Bureau of Entomology.*

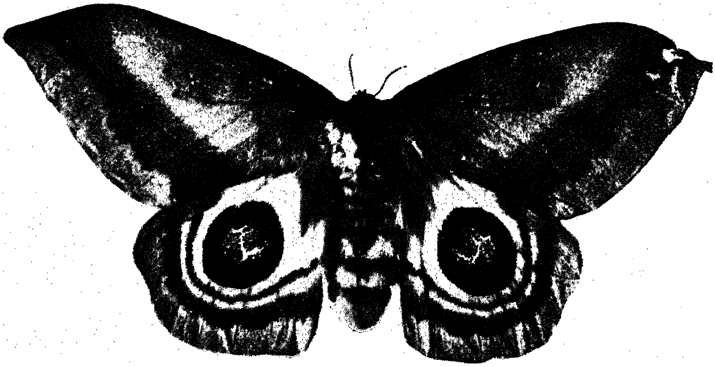

Fig. 1. Female Moth.

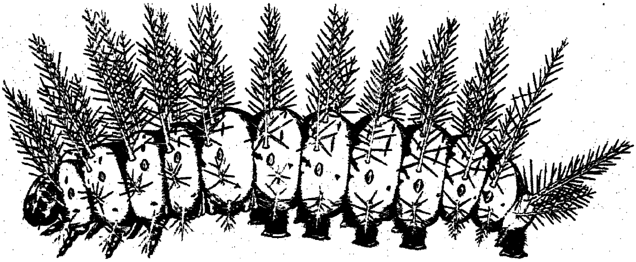

Fig. 2. Caterpillar in last stage.

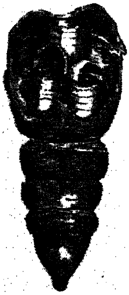

Fig. 3. Pupa of moth containing pupae of fly.

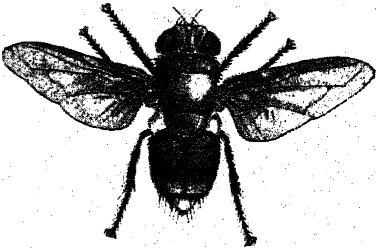

Fig. 4. Parasitic fly (*Willistonia esuriens*).

AUTOMERIS JANUS AND ITS PARASITE.

EXPLANATION OF FIGURES.

FIG. 1. Female moth, reduced; in life the moth measured five inches across the wings.

FIG. 2. Caterpillar in last stage of development, slightly under natural size.

FIG. 3. Pupa slightly reduced; actual length two inches.

FIG. 4. Parasitic fly slightly enlarged, expanse of wings 1$\frac{1}{8}$ inches.

A BIRD INJURIOUS TO RICE.

The Yellow Headed Cacique.—(*Agelaius icterocephalus*, L.)

Agricultural Instructor C. M. Roach has sent the following note from the Oropuche rice fields on the yellow headed Cacique: "As soon as rice seed is sown for making nurseries these birds swoop down in flocks of as many as two hundred and pick up the grains. Until about ten or fourteen days after sowing, the nursery is not safe from them for they readily pull up the recently rooted seedlings which they leave to wither on the ground after they have detached the seed. After the period just mentioned the small plants have usually become too strong to be easily pulled up and are not interfered with any more."

The yellow headed Cacique belongs to the family of *Icteridae* which includes black birds, corn birds, orioles, &c. They are amongst the birds protected for the whole year under the Wild Birds and Wild Animals Protection Ordinance. Under No. 151 this bird, which is 7¾ inches in length, can be seen in the Royal Victoria Institute Museum. Leotaud describes it as follows:—A pretty bright lemon yellow covers the whole head and the throat like a veil. All the rest of the plumage is deep black with a slight sheen. The same black colour covers the lorum and surrounds the base of the beak; legs, beak, and iris black. The female has a greenish yellow spot between eye and nostril. The top of the head and a little of the nape, brown mixed with dark green especially at the margins of the feathers. Base of the nape and the rest of the upper parts black with dark green at margins of feathers except at the rump. Throat and neck yellow, like the male, but this yellow is of a brighter tint. Breast, abdomen and flanks yellowish green on a dark ground colour. Rest of the lower parts blackish. The remiges and their coverts have a slight greenish margin, otherwise like the male.

The young male looks like the female. With regard to habits Leotaud states that the yellow headed Cacique is very common. It is always in flocks and its favourite habitat is in the midst of flooded places (such as rice fields). It very often comes near to houses to look in paddocks for fly larvæ of which it is very fond, it does not despise grain, it also often flies to roads to scratch in horse droppings in search of grains of oats. Its flight is easy and jerky. Its life is peaceful as entailed by its social habits. Its note is weak and insignificant but is at times replaced by a kind of warbling that turns into a cackling when uttered by the whole flock. It cannot stand captivity.

This bird is also insectivorous and is of use in spite of its fondness for germinating rice; it should therefore not be killed and as it is destructive to rice for only the first fortnight it would appear that the best way to get over this bad habit would be to protect nurseries that as a rule are never very extensive, by means of covers of wire netting, or any cheap light cloth.

F. W. U.

THE PRESERVATION OF BLACK EYE PEAS.

Pea weevils are very injurious to Black eye peas when kept in storage for any length of time. The peas are often attacked when in the field, but this form of damage is trifling when compared with the ravages which take place after they are packed and kept in bags. It is well known that under these conditions they will ony last a couple of months. Attacks can be prevented by cold storage, but as this method is not practicable for a great many people, especially for the small proprietors in the country, the use of lime is recommended as a preservative. According to Mr. Z. R. Metcalf of the North Carolina Agricultural Experiment Station, peas can be preserved by storing them in air slaked lime at the rate of one part lime to two parts peas by weight. The air slaked lime is poured over the peas and then they are put back into the bags. The experiments were carried out in America and it is possible that there may be differences for Trinidad, but the treatment is so simple that it is well worth a trial. From figures given by Mr. Metcalf, forty-one weevils emerged from one thousand peas treated with lime as mentioned above. If the lime is increased there will be fewer weevils, for instance when four parts of lime were used with one part of peas only seven weevils emerged from one thousand peas; equal parts lime and peas resulted in twenty-four weevils.

F. W. U.

CARRIAGE OF PARASOL ANT POISON.

THE following Railway Bye-Law has been published in the *Trinidad Royal Gazette*:—

1 The Railway (Carriage of Explosives) Bye-laws, 1915 are amended by inserting after the words "This traffic will not be stored in any of the Railway sheds or enclosures" in the "Conditions relating to the carriage of Bisulphide of Carbon and ant destroyer containing Bisulphide of Carbon" in Appendix II of the said Bye-laws, the following words :—

> The General Manager may, in his absolute discretion, permit of small quantities of Bisulphide of Carbon and ant destroyer containing Bisulphide of Carbon being carried in strong stoppered bottles tied over, and luted, securely packed in sawdust, or mixture of sawdust and chalk, in strong wooden cases. Each bottle must be separated from the other bottle by a wooden partition and the total weight of Bisulphide of Carbon in each case not to exceed 30 lb.

The case to be securely fitted that the packing cannot escape, and to bear outside in bold letters the nature of the contents and the words "HIGHLY INFLAMMABLE"; not to be sent by any train arriving at its destination after 4.00 p.m.; not to be stored in any of the Railway buildings; and not to be accepted on any condition if showing scent or sign of leakage.

Made by the Governor in Executive Council this 14th September, 1916.

HARRY L. KNAGGS,
Clerk of the Council.

SILK CULTURE.

REPORT ON SOME COCOONS PRODUCED IN TRINIDAD.

By Professor H. Maxwell-Lefroy.

In March, 1916, cocoons of eri and mulberry moths reared by Mr. M. C. Glaudon were forwarded to Professor H. Maxwell Lefroy, Imperial Silk Specialist, India, who was good enough to report as follows:—Herewith I enclose a copy of a letter from the Manager, Rose Filatures Concern, Ramnugger Plassey P.O., expressing his opinion on the quality of the white and mulberry cocoons.

The Eri cocoons are clean, of good colour, shape and firmness. The percentage of silk is high and the cocoons would rank with the best quality from Assam. Value uncertain: present value about eighteen pence a pound in Calcutta.

Letter from Rose Filature Concern: "I duly received your letter of 20th ultimo and the 3 tubes white and 2 tubes yellow cocoons reared in Trinidad, but I regret to say that although the cocoons both white and yellow, seemed fair in quality from their appearance, they did not reel well in the basin. The thread coming off in layers and the cocoons showing an inclination to sink to the bottom, which made it impossible to reel an even denier or good quality silk. This may be due to the cocoons getting damaged in transit, or to the worms spinning in bad weather or even in a damp room. Any way it is not possible to carry out a proper test with cocoons thus affected, but from their general appearance and that of the silk obtained, I should say they would have otherwise given fair results, the yellow better than the white.

A similar defect is noticed in Bengal cocoons when reared under the above mentioned conditions. They are then known as "gayla" cocoons.

OILS AND OIL SEEDS.

REPORTS on the economic uses and commercial value of the seeds of the Gru-gru palm (*Acrocomia sclerocarpa*) have already been recorded in this *Bulletin*. The results of the investigation of one sample made by the Imperial Institute, will be found in Vol. XII. 1913, 137-8 and the other, by Mr. A. W. Knapp in Vol. XIII. 1914, 104-6, in which article Mr. H. S. Shrewsbury, Principal Assistant Analyst, discusses and summarizes the results obtained. In both these cases the material investigated was obtained from Trinidad.

A similar investigation has recently been conducted by the Imperial Institute on the fruits of the Cokerite or cocorite palm of British Guiana, and published in the *Bulletin of the Imperial Institute*, XIV. 1916, 8-13. Unfortunately the exact botanical determination of the plant is not given, apparently due to insufficient material being sent, but it is considered to be possibly *Maximiliana regia*. The Cocorite palm of Trinidad is usually regarded as *Maximiliana caribæa* Griseb. and Wendl. In the *Bulletin, Botanic Department, Trinidad*, III. 1897, 9, there is a note by Mr. J. H. Hart that *M. regia*, although previously recorded from the colony, had never been found by him.—(ED.)

Cokerite Fruits and Oil from British Guiana.

The cokerite palm occurs in most parts of British Guiana, except on the immediate coast-land. As a rule it grows singly, but occasionally a good number of the trees occur near together. It is one of the most striking of British Guiana palms, the almost erect leaves having the appearance of curled plumes. The various parts of the plant are largely used by the natives: the young leaves are used for thatching huts, darts for blow-pipes are made from the splinters of the woody midribs, the pericarp of the fruits is scraped off and eaten, while the kernels, called "mareepa" by the Carib tribes, form in times of scarcity almost the sole food of the Indians. The kernels are also employed by the natives for the extraction of oil.

Samples of cokerite fruits and cokerite kernel oil from British Guiana were received at the Imperial Institute in August, 1915.

The fruits were submitted by the Imperial Institute for identification to the authorities of the Royal Botanic Gardens, Kew, who stated that they were derived from a species of Maximiliana, possibly *M. regia*.

The fruits were dark brown, rounded at the base and pointed at the apex, and measured 1½ to 2 in. in length and from ¾ to 1 in. in diameter. The rounded was covered by a thin, papery bract.

Each fruit consisted of pericarp and nut including the kernel. The dark brown pericarps were tough and fibrous externally, whilst internally they were soft and pulpy and contained oil. The nuts which were of a pale brown colour, measured from 1½ to 1¾ in. in length and from ½ to ¾ in. in diameter, and consisted of a hard, woody shell enclosing two or three kernels.

The kernels were long, narrow and flattened in shape, measuring about 1 in. in length and ½ in. in breadth. They were covered with a greyish-brown mottled skin, whilst internally they were whitish and resembled palm kernels in consistency.

The sample of kernel oil consisted of a fairly hard cream-coloured fat, with an odour resembling that of coconut oil. It was free from dirt and moisture, and appeared to have been well prepared.

FRUITS.

The fruits were found to have the following percentage composition by weight :—

Bracts ...	... 12·4	Shell ...	... 53·6
Pericarp ...	... 17·0	Kernels ...	... 17·0

The nuts consisted of shell, 76 per cent., and kernels, 24 per cent.

The average weight of a fruit was 10·6 grams, of a nut 7·5 grams, and of a single kernel 1·3 grams.

PERICARP OIL.

The brown oily pericarp contained 12·1 per cent. of moisture and yielded 15·0 per cent. of a semi-solid, orange-red oil, equivalent to a yield of 17·1 per cent. from the dry plup, or 2·6 per cent. from the whole fruit. The oil was submitted to chemical examination, and the results are shown below in comparison with those recorded for palm oil (the pericarp oil of the fruit of the oil-palm, *Elæis guineensis*) :—

		Cokerite pericarp oil.	*Palm oil.*
Solidifying point of fatty acids	...	25·5° C.	35·8°–46·4° C. (usually 44·5°–45·0° C.)
Acid value ...	... ...	28·6	...
Saponification value	... ...	211·6	196·3–205·5
Iodine value ...	... per cent.	51·4	53–57·4

1. See *Bulletin Imperial Institute* (1909, VII. 389).
2. Milligrams of potash for 1 gram of oil.

This cokerite pericarp oil resembles palm oil in appearance, but it obviously differs somewhat from it in chemical composition. There is however, no doubt that cokerite pericarp oil would be readily marketable if it could be obtained in quantity.

KERNELS.

The kernels, as extracted from the fruits at the Imperial Institute, contain 11·3 per cent. of moisture, and yielded 56·9 of a fairly hard, cream-coloured fat, with an odour resembling that of coconut oil. This is equivalent to a yield of 64·1 per cent. of oil from the dry kernels, or 9·7 per cent. from the whole fruit.

The kernel oil forwarded from British Guiana and the oil extracted from the kernels at the Imperial Institute were examined with the following results, which are compared with those recorded for palm kernel and coconut oils:—

	Oil prepared in British Guiana.	Oil prepared at Imperial Institute.	Palm Kernel Oil.	Coconut Oil.
Specific gravity at $\frac{100^\circ \text{ C.}}{15^\circ \text{ C.}}$ ...	0·8681	0·8668	0·8731	0·8736
Melting point (open tube method) ...	27·5° C.	27° C.	23°–30° C.	23°–27° C.
Solidifying point of fatty acids ...	—	24·2° C.	20·0°–25·5° C.	21·2°–25·2° C.
Acid value	4·6	3·1		—
Saponification value	252·3	253·0	242·4–254·8	245–268·4
Iodine value ... ... per cent.	12·8	13·0	10·3–17·5	8·0 10·0
Hehner value...	—	88·9	91·1	88·6–90·5
Insoluble fatty acids, ... per cent.	—	88·6	—	—
Unsaponifiable matter, ... per cent.	—	0·3	—	—
Volatile acids, soluble	—	3·0	5·0–7·6	6·65–8·0
,, ,, insoluble... ...	—	7·0	10–12	15–20

(1.) Milligrams of potash for 1 gram of oil.

(2.) Cubic centimetres of decinormal alkali required to neutralise acid from 5 grams of oil.

The results indicate that the oil obtained from cokerite kernels is similar to palm kernel and coconut oils, the chief difference being that it yields somewhat smaller quantities of volatile acids.

KERNEL MEAL.

The meal left after the extraction of the oil from the kernels was a pale brown material, with a mild and not unpleasant taste somewhat suggestive of coconut. It was submitted to chemical examination at the Imperial Institute, and the results obtained have been re-calculated for a cake containing 7·0 per cent. of fat so that they may be conveniently compared with the figures recorded for palm kernel and coconut cakes:—

	Cokerite meal (calculated for cake with 7·0 per cent. of fat).	*Palm kernel cake (expressed).*	*Coconut cake (expressed).*
	Per cent.	*Per cent.*	*Per cent.*
Moisture	8·6	12·0	8·5
Crude proteins	15·0	18·5	24·5
Consisting of			
True proteins ...	14·7	—	—
Other nitrogenous substances	0·3	—	—
Fat	7·0	5·5	8·3
Starch, &c. (by difference) ...	52·5	50·0	39·8
Fibre	12·6	10·0	12·8
Ash	4·3	4·0	6·1
Nutrient ratio (1) ...	1 : 4·6	1 : 3·4	1 : 2·4
Food units (2)	108	110	122

(1.) The ratio between the percentage of crude proteins and the sum of the percentages of starch and fat, the latter being first converted into its starch equivalent.

(2.) The total obtained by adding the percentage of starch to 2·5 times the sum of the percentages of fat and crude proteins.

The foregoing results indicate that the residual meal from cokerite kernels should have a feeding value approximately equal to that of palm kernel cake and somewhat lower than that of coconut cake.

COMMERCIAL VALUE OF COKERITE FRUITS.

It will be seen from the foregoing that the cokerite fruits have a structure analogous to that of oil-palm fruits (*Elæis guineensis*), and that, like the latter, they furnish two products which need consideration from a commercial point of view, viz.:—

(1.) Pericarp oil.

(2.) Kernel, yielding oil and feeding cake.

The principal difference between cokerite and oil-palm fruits, so far as commercial value is concerned, is that the former have a thin pericarp, giving a comparatively small yield of oil, whereas oil-palm fruits have a thick, soft pericarp, rich in oil. The essential difference between the two kinds of fruits are shown in the following table :—

	Percentage by weight in the fruit.		
	Pericarp.	*Pericarp oil.*	*Kernel.*
Cokerite fruits	17·0	2·6	17·0
Oil-palm fruits :			
(*a.*) With thick-shelled nuts ...	25–35	16–19	13–19
(*b.*) With thin-shelled nuts ...	69–83	35–48	7– 9

In West Africa only oil-palm fruits with thick-shelled nuts are obtainable in sufficient quantity to be worth working, and consequently only this variety need be considered for comparison in the present instance. It is clear that since this variety of oil-palm fruits yields nearly seven times as much pericarp oil (palm-oil) as cokerite fruits, the latter from a comparatively poor source of pericarp oil, and it is scarcely worth while to consider them as a commercial source of this product, except as a possible by-product in working the fruits for kernels.

The yield of kernels, on the other hand, compares favourably with that from the best varieties of oil-palm fruits. Moreover since the kernels yield rather more oil than palm kernels, and the oil itself is quite comparable with palm kernel and coconut oils, there can be no doubt that cokerite kernels would fetch the same price as palm kernels or possibly a little more. The present price of palm kernels in Liverpool is £20 5s. per ton (May, 1916).

The sole question, therefore, is as to whether cokerite kernels can be produced in British Guiana at a price which will admit of their being sold in Liverpool at about the same price as palm kernels. In this connection it is important to ascertain whether the fruits are obtainable in British Guiana in large quantities in easily accessible areas, and the Imperial Institute has therefore asked for information on this point. Further, it would probably not be remunerative to export the whole fruits from British Guiana, so that it becomes important to consider the extraction of the kernels.

It is not likely that it would be possible to do this by hand in British Guiana, and so far as is known at the Imperial Institute, there is at present no machine suitable for this purpose.

The extraction of the babassu kernel (*Attalea* sp.), however, presents a similar problem. It is stated that a machine is now in use in Brazil for extracting babassu kernels, and the Imperial Institute is making enquiries there on this subject. It is possible that this machine will also be suitable for cokerite fruits, and if so it might be feasible to treat the cokerite fruits in the machine to obtain a mixture of (*a*) kernels and (*b*) shells and pericarp. The former could be separated and exported, whilst the mixed shells and pericarp could perhaps be worked by a modern extraction process for the production of pericarp oil.

Until information is available regarding the Brazilian machine, all that can be done is to ascertain whether the supplies of cokerite fruits in British Guiana are large and sufficiently accessible to warrant their serious consideration as a workable product. It was suggested that if this seems likely, a consignment of the fruits should be sent to the Imperial Institute for technical trial.

BIRDS.

THE VALUE OF BIRDS TO MAN.

By James Buckland, London, England.

The following is the first instalment of an important article on the "Value of Birds to Man" which appeared in the *Annual Report of the Smithsonian Institute* for 1913 pp. 439-58. It should be of value in particular for use in the Schools. It is important that the wanton destruction of birds in this Colony should be checked.—(Ed.)

NUMBER, FECUNDITY AND VORACITY OF INSECTS.

Man imagines himself to be the dominant power on the earth. He is nothing of the sort. The true lords of the universe are the insects. While it is that man has invented and perfected so many destructive agencies that he has attained to a predominance over the most fierce and powerful mammals and the most deadly reptiles, it is also true that in face of an attack of insects he and all his works are set at naught.

"A little one shall become a thousand and a small one a strong nation." Few people know how enormous is the number of insect species or how amazing is their power of multiplication. The number of insect species is by far greater than that of the species of all other living creatures combined. Over 300,000 have been described, and it is considered not improbable that twice that number remain to be described. Practically all living animals as well as most plants, furnish food for these incomputable hordes. More than this Kirby, in the *Introduction of Entomology* devotes no less than five entire epistles to the injuries we sustain from insects, while two only are sufficient to describe the benefits they yield.

The fecundity of certain forms is astounding, the numbers bred reaching such prodigious proportions as to be almost beyond belief. Riley once computed that the hop aphis developing thirty generations in a single year, would, if unchecked to the end of the fourth generation have multiplied to the inconceivable number of ten sextillions of individuals. Noting the preceding, Forbush says if this brood were marshalled in line, ten to the inch, it would extend to a point so sunk in the profundity of space that light from the head of the procession travelling at the rate of 184,000 miles per second would require 2,500 years in which to reach the earth.

Kirkland has computed that one pair of gypsy moths, if unchecked, would produce enough progeny in eight years to destroy all the foliage in the United States.

A Canadian Entomologist states that a single pair of Colorado beetles or potato bugs, as we call them, would, without check, increase in one season to sixty millions. At this rate of multiplication the disappearance of the potato plant would not be long delayed. The chinch bug, a fecund and destructive pest, has been found in a clump of grass eight inches in diameter to the number of twenty thousand. The progeny of this colony alone if unchecked, would soon become incomputable hordes, devastating wide areas of the earth's surface. Those of you who have been in South Africa probably have seen locusts in flight which fill the air and hide the sun. What a potency for evil lies hidden in the tiny but innumerable eggs of these ravening pests. If every egg was permitted to hatch and every young locust to come to maturity, the consequences would be too dreadful to contemplate.

The voracity of insects is almost as astounding as their power of reproduction. The daily ration in leaves of a caterpillar is equal to twice its own weight. If a horse were to feed at the same rate, he would have to eat a ton of hay every twenty-four hours. Forbush says that a certain flesh-feeding larva will consume in twenty-four hours two hundred times its own weight, a parallel to which, in the human race, would be an infant consuming, in the first day of its existence, one thousand five hundred pounds of beef. Trouvelot, who made a special study of the subject, affirms that the food taken by a single silkworm in fifty-six days equals in weight eighty-six thousand times its original weight at hatching. What a destruction this single species of insect could make if only a one-hundredth part of the eggs laid came to maturity.

MISSION OF THE BIRDS IN ORGANIC NATURE.

Who or what is it that prevents these ravening hordes from overrunning the earth and consuming the food supply of all? It is not man. Man, by the use of mechanically applied poisons, which are expensive, unnatural, and dangerous, is able to repel to an extent the attacks on his orchard and garden. Out in the fields and in the forests he becomes, before any great irruption of insects, a panic-stricken fugitive. Neither is it disease, or the weather, or animals, or fungi, or parasitic and predaceous insects within their own ranks. However large may be the share of these particular natural agencies in keeping insects in check, experience has shown that it is lamentably insufficient. Then what is it? The bird. Bird life, by reason of its predominating insect diet, is the most indispensable balancing force in nature.

MAN AT WAR WITH NATURE'S LAWS.

Yet man has been engaged in the past half century in the blind and wanton destruction of this essential part of nature's great plan. He has taken no thought of the needs of the hour, nor concerned himself with the wants and claims of those to come. Within the space of a few years under no constraint of necessity, he has carried out a policy of destruction more effective than that accomplished in centuries by the slow processes of nature. Armed with a weapon that annihilates space, he has constituted himself the master and the ruler of the animal world, and has delegated to himself the right to adopt a utilitarian standard by which he measures all other forms of life. It is not for man to say what shall live and what shall be destroyed. The whole system of nature is in exquisite poise, and it is not possible to lay rough hands upon it without disturbing it in directions and on a scale which at the time may not be guessed at. If we remove or reduce the working part of one living organism which acts as a check on another, the latter, freed from restraint, will inevitably multiply. As we destroy the insect eating birds, the insects on which they prey will multiply to scourge us as Egyptian plagues. It is a fact which agriculture has learned to its cost in many parts of the world.

SERIOUS CONSEQUENCES OF BIRD DESTRUCTION.

Some years ago the agriculturists of Hungary, moved to the insane step by ignorance and prejudice, succeeding in getting the sparrow (*Passer domesticus*) doomed to destruction. Within five years the country was overrun by insects, and these same men were crying frantically for the bird to be given back to them, lest they should perish. The sparrow was brought back, and, driving out the hordes of devastating insects, proved the salvation of the country.

In the island of Bourbon once, because of the same ignorance and prejudice, a price was set on each martin's head. The birds all but disappeared, and the grasshoppers took possession of the island. The edict of banishment was hurriedly revoked and the exiles recalled. Fortunate, indeed, was it for the island of Bourbon that the bird was not beyond recall.

During the year 1861 the harvest of France gave an unusually poor return and a commission was appointed at the instance of the Minister of Agriculture to investigate the cause of the deficiency. By this commission the deficiency was attributed to the ravages of insects which it was the function of certain birds to check. These birds it appears, had been shot, snared, and trapped throughout the country in such numbers that but little repressive influence had been exerted upon the insects. It was concluded that by no other agency than the birds could the ravages of insects be kept down, and the commisson called for prompt and energetic remedies to prevent the destruction of birds.

For some years prior to 1887 vast numbers of red-winged black birds were poisoned in the spring and autumn around the corn fields of Nebraska. This was done in the belief that the black birds were damaging the crops, especially the wheat. Great numbers of prairie chicken, quail, plover, and various other insect-eating species were destroyed at the same time by eating the poisoned grain. Then came 1887 and with it Nemesis. The locusts appeared in countless numbers. There were no birds to eat them, and Nebraska mourned.

In 1895 the ravages of two species of cut-worms and some ten species of locusts produced a famine in the region of Ekaterinburg, which is in Russian Siberia. The local Society of Natural Sciences enquired into the cause which had permitted such a numerous propagation of insect pests, and reported that it was due to the almost complete destruction of birds, most of which had been killed and sent abroad by waggon loads for millinery purposes.

Those grass ticks which make the keeping of cattle almost impossible in Jamaica, are not mentioned in the records of the early nineteenth century. The appalling destruction in more recent years of insect-eating birds, chiefly to supply the demands of the millinery market, has led to an inordinate increase of the ticks and to the dying out of all but Indian cattle. This correlation of birds and ticks—to say nothing of mosquitoes and other insect plagues in Jamaica—was put fully and circumstantially before the Secretary of State for the Colonies by a deputation in 1909.

E. D. Morel has recently pointed out that the reckless destruction of the Guinea fowl (*Numida*) in French West Africa is co-incident with the increase of certain germ diseases, and, above all, with ravages to crops on the part of the larger insects, especially beetles, the grubs of which were devoured by the Guinea fowl, which scratch them out of the ground.

Though I could give a hundred cases similar to the foregoing, I must rely on the few I have cited to show that the wholesale destruction of birds is surely followed by disaster to man.

VALUE OF THE BIRD IN CHECKING INSECT IRRUPTIONS.

When the Mormons first settled in Utah, their crops were destroyed utterly by myriads of black crickets, that streamed down from the mountains. Promising fields of wheat in the morning were by evening as bare as though the land had not been sown. The first year's crop having been destroyed, the Mormons had sowed seed the second year, and again crops promised well. But again the crickets appeared, devouring every blade of wheat, and the followers of Joseph Smith were on the verge of starvation. At this juncture Franklin's gull came by hundreds of thousands, and feeding greedily on the crickets, freed the fields of the pests. The settlers of Salt Lake regarded the advent of the gulls as a heaven sent miracle, and practically canonised the birds.

Since that hour this black-headed gull has been made a faithful servitor of the farmers of Utah. At the present moment a movement is on foot to erect a monument to this bird in Salt Lake City, thus showing a befitting and seemly sense of gratitude for its inestimable services in guarding the States from the ravages of insects.

It is the common practice with all settlers in a new country to at once set about killing the native birds in a thoughtless and fool-hardy manner. This stupid practice is all the more deplorable, because an enormous increase of insect pests invariably attends the operation of the pioneer agriculturist. Finding in cultivated crops new and more succulent sources of food supply, insects change their primitive habits to swarm and multiply exceedingly upon the fertile fields of man's creation.

When the farmers in New Zealand began to break the virgin soil on an extensive scale, a certain caterpillar, which hitherto had gleaned a somewhat meagre sustenance from the scanty native verdure of the open lands, disappeared from its old haunts and attacked the cultivated areas. So speedily did it increase by reason of a more favourable environment that it soon became a blasting plague. It came not singly, nor even in battalions, but in mighty armies which laid waste the land. I have seen these atoms cover the pastures in such numbers as to make the green one brown. I have seen countless millions of them pass out of one cornfield, having stripped every stalk bare, cross the road in solid phalanx, and pass into another. I have seen big mobs of sheep mustered in great haste and driven to and fro over these serried ranks that they might crush them with their scurrying feet. I have seen every horse roller in a district brought up hurriedly, like steam engines to a fire, and drawn backward and forward over the crawling masses until the cylinders stuck fast in a mire of squashed insects. I have seen huge ditches dug in an attempt to stop the the invaders' progress. The effort was as futile as that of a child who builds a bank of sand by the sea, thinking it will stem the oncoming tide. Even railway trains were brought to a standstill, the wheels of the engines being unable to grip the rails owing to the hordes of caterpillars which were crossing the line.

In time it became abundantly clear that if this disastrous condition of affairs continued it would be useless to attempt to carry on agriculture in New Zealand. Realising that any attempt which they might make to rid the smitten land of the plague would be but a mockery, the farmers turned their eyes longingly to the natural enemy of the caterpillar—the bird. But the native birds—though he had lived in closest companionship with the Maoris—had been taught the treachery of the white man in a school that reeked with blood, and those that had not been killed had retreated from the vicinity of the settlements, visiting the insect-ridden fields occasionally only.

Wherefore insectivorous birds from the old country were introduced, and the one that multiplied most rapidly was the house sparrow. And *Passer domesticus* soon cut short the career of the caterpillars.

As digestion is exceedingly rapid in birds, and as they feed for the most part throughout the day, they are peculiarly adapted for the suppression of abnormal outbreaks of vegetable as well as of animal life.

That formidable imported weed, the Scotch thistle, threatened at one time to overrun the whole of New Zealand. Much time and money was spent by the settlers in cutting off the plants close to the ground, and in pouring turpentine upon the split stumps, hoping thereby to kill the roots. Vain labour. The wind-driven clouds of thistle down, which were planting the weed far and wide, grew yearly denser and more frequent. At length the fields became a packed growth of prickly plants, which nothing could face.

The sparrows took to eating the seed. In tens of thousands they fed on it, giving it the preference of all other hard food, and the weed was conquered.

To-day in New Zealand, the sparrow is looked upon as an impudent thief, without a redeeming feature in its character. No one, of course, could say what would happen if the bird was dismissed from the country, though it is probable that the Dominion would be again overrun with thistle and caterpillars. Setting aside this hypothetical question, the good the sparrow does must outweigh the evil. This statement receives confirmation in the bountiful harvests with which New Zealand is blessed. Never were the sparrows more numerous; never the complaints against them more bitter; yet the yield of grain is without precedent.

The growling of the New Zealand farmer at the sparrow justifies Virgil's complaint of the "miserly husbandman." Miserly, indeed, and blind. Not a grain will he give to the bird which had laboured unceasingly with him for the production of his crops; but whole fields of wheat to the caterpillar.

Parenthetically I may mention that, though I have written here in defence of the introduction of the European sparrow into New Zealand, I am not an advocate of acclimatization. It is true that one can point to cases where a foreign bird has been introduced to perform the function of a native species that has been driven out, and where that function has been performed satisfactorily. But, as a rule, such substitutions are fraught with danger. Birds so rapidly change their habits in new surroundings that few species remain loyal to the reputation for honesty which they enjoyed in the land of their origin. Like most aliens, it would have been better had they remained in their own country. Although the spread of civilisation unconsciously demands some victims, man, and indigenous birds can, speaking generally, occupy the same territory without much difficulty. If one requires truth of this, he has but to turn his thoughts to British India, where native birds of all kinds, owing to the protection accorded them by the Hindu doctrine of the sanctity of all life, are found living in closest proximity to dense human populations.

The moral of which is that it behoves every man who has the welfare of his country at heart to do all in his power to foster native birds.

In Australia a plague of grasshoppers periodically visits the fields to devour the crops. The ruin they would otherwise bring on the farmer is averted by the good offices of ibises and other native birds. As a destroyer of grasshoppers, the straw-necked ibis (*Carphibis spinicollis*) has no equal among birds. Dudley Le Souef, the Director of the Melbourne Zoological Gardens, some years ago visited a rookery of this bird in the Riverina, and, after a careful estimate, came to the conclusion that the minimum number of birds breeding there was 200,000. He procured a number of specimens and ascertained by actual counting that the contents of an average crop of an adult bird were 2,410 young grasshoppers, 5 fresh-water snails, and several caterpillars, which, multiplied by 200,000, amounts to a total of four hundred and eighty-two million and odd grasshoppers, as well as vast numbers of caterpillars and snails. "Then, again," says Mr. Le Souef "the average number of young is about two and one-half to each pair of parent birds, and the contents of their stomachs must reach an enormous total, as they all seemed gorged with food."

As this enormous amount of food is being eaten every day by ibises in Australia during the hatching time of the grasshoppers, some little idea can be formed of the immense utility these birds are to the farmer. Without them the balance of nature would be disturbed and successful agriculture would be impossible.

In addition to its great value as a destroyer of all-devouring insects the straw-necked ibis feeds with avidity on the fresh-water snail—the host of the dreaded liver fluke, which sheep so easily get in certain damp localities.

Yet, in face of these facts, people surreptitiously visit the breeding grounds of these birds and collect their eggs by the cartload. One party in 1912, having gathered more than it required, drove away and left 4,830 eggs to rot on the ground.

THE VALUE OF BIRDS IN FORESTS.

Omitting all mention of many another notable instance of the quelling, of insect outbreaks by birds, I will pass at once to the consideration of these perennial services which act as a constant check on the undue increase of insects, rodents, weeds and other pests.

Birds attain their greatest usefulness in the forest, because the conditions there closely approach the primeval.

Forest trees have their natural insects foes, to which they give food and shelter, and these insects in turn have their natural enemies, among the birds, to which the tree also gives food and shelter. Hence it follows that the existence of each one of these forms of life is dependent upon the existence of the others. But for the trees the insects would perish, and but for the insects the birds would perish, and but for the birds the trees would perish; and to follow the inexorable laws of nature to the conclusion of their awful vengeance, but for the trees the world would perish.

Consider for a moment the life of a tree in connection with the insects that prey upon it. At the very beginning, before the seed or nut has germinated, it may be entered by a grub which destroys it. Should, however, the seed or nut be permitted to grow, the roots of the seedling may be attacked by beetles. Escaping this danger, a worm lays its eggs in the cracks of the bark. On hatching, the worm or borer perforates a hole in the stem. This hole, admitting water from every passing shower, causes a decay in the wood to commence, from which the tree may never recover. Other borers feed upon the bark, eating the soft inner layer and the sap. The twigs are affected by the larvæ of certain beetles, which act as girdlers, sometimes destroying limbs over an inch in diameter. Weevils bore under the bark and into the pith, making excavations in which the eggs are laid. For the same purpose the cicada makes a terrible wound, which often proves fatal. The limbs of trees are affected by aphides, which puncture them and feed upon their juices, exhausting the sap. Many species of plant lice and scale insects infest trees, doing great damage, while over 100 different species of gall flies are parasitic upon them. The buds of trees are entered and destroyed by the larvæ of certain moths, while the leaves are devoured by caterpillars. To take the oak as an example, is known that altogether over 500 species of insects prey upon it. Finally, be it remembered that in the bark and in the underlying tissues lie the vital energies of a tree.

It is difficult to perceive the usefulness of these insects which feed on different parts of the tree, though they may, perhaps, when in normal numbers, exert a useful influence by a healthful and necessary pruning. It is certain, however, that if they were not in turn preyed upon by birds, they would so increase in numbers that the tree could not survive the injuries they would inflict.

How dependent trees are on birds for their existence may be gathered from the following illustration:—As many of you probably know, trees breathe through their leaves. Consequently, if the buds of the leaves are prevented from developing, or are eaten, when developed, by caterpillars, the tree is weakened. Many coniferous trees will die if stripped of their foliage for one year. Decidous trees, if deprived of their respiratory organs for several years in succession, will also perish, though these trees linger as a rule for two or even three years before finally succumbing.

Now, injury to its breathing organs is not the only danger to which a tree afflicted in this way is subjected. The tree being in a weakened condition, is at once beset by beetles and other borers, who multiplying rapidly under such favourable conditions, tunnel under the bark until all the vital tissues of the poor tree are wasted. Thus a tree which might have recovered from the injury to its lungs falls a victim to attacks of an insidious enemy which took advantage of its enfeebled state.

Woodpeckers or other birds of similar feeding habits would have flown to the rescue of the tree and possibly saved its life; but when that corrective influence is missing, the tree must die.

This illustration of the dependence of the tree on the bird and of the bird on the tree, is, of course, but one of the long series that could be cited, and it is because of this most delicate adjustment between the tree, the insect and the bird that I regard as profoundly true Frank M. Chapman's statement "that it can be clearly demonstrated that if we should lose our birds we should also lose our forests."

It is an ignorant schoolboy who does not know that if we lost our forests we should lose also the moisture necessary for the production of crops upon which man is dependent for his living.

If, in arrogance, and folly, man exterminated the bird, thinking himself capable of taking its place, he might be able to make shift with his sprays to save some portion at least of his orchard and gardens; but of what avail would be his puny efforts to protect from the ravening maws of insects the forests of America and Africa, the jungles of Asia, or the bush of Australia? Should he not, then, protect by every means in his power every one of the forest birds, who, as a matter of course, and without trouble and expense to him, ordinarily accomplished, on his behalf, the herculean task of saving the lives of the trees! One would think so. Yet in these very regions, in these vast areas of valuable timber, every trunk of which man will some day need, there being killed annually millions of the feathered guardians of the tree, and killed, too, for no worthier purpose than that, dead, they may defame a woman's head.

THE VALUE OF THE BIRD IN THE ORCHARD.

For man's purposes the work of the bird in the orchard is not so thorough as that done by them in the forest. Birds are the slaves of nature, and, in the main, nature's endeavours are put forth only to produce such fruits as will such ensure the perpetuity of each species of tree. With man the case is altogether different. His main object is not the propagation of trees, but the production of a giant gooseberry. Moreover, by introducing arsenical spraying, tarred and greased bands, and other devices to counteract the evil action of insects, he has, to a certain extent, taken upon himself the office of the bird. In this he is wise, for it must be admitted that if he wishes a large crop of fruit he must himself prevent the inroads of those insects which attack the fruit directly. It cannot be expected of the bird that it would become an efficient ally of man in protecting the artificially produced fruit from the attacks of the numerous insects that are drawn from the orchards by a vastly increased quantity of fruit, of a vastly better quality than the natural product.

For all that, fruit growers are largely indebted to the bird for a great part of their annual crop.

In the Union of South Africa for instance, it is found that near towns, where the birds have been more especially persecuted and driven away, the growing of fruit and other market produce has become increasingly difficult, or even impossible, owing to the prevalence of insect pests which are not affected by spraying operations.

But let us suppose for a moment—though the supposition is absurd,—that the modern fruit grower could do without the services of the bird.

Would that give him a right to slay it? Apart altogether from the agriculturist, what of the millions of people who, as an increment to their ordinary livelihood grow fruit, but who cannot afford either the time or the money to treat their trees in the most approved and scientific way?

What would happen to this poorer class of fruit growers if they were deprived of the services of the bird is best seen in what happened to Frederick the Great. This worthy, in a fit of passion because a flock of sparrows had pecked at some of his cherries, ordered that every small bird that could be searched out to be instantly killed. Within two years his cherry trees, though bare of fruit, were weighed down with a splendid crop of caterpillars.

Call the bird in the orchard an evil if you will; but it is a necessary evil, and the fruit grower must make up his mind to pay the bird his wages lest worse befall.

THE SERVICES OF THE BIRD IN THE GARDEN.

The garden is the insect's paradise. It fares sumptuously every day on the most succulent of vegetable foods. Every opportunity is thus offered for its increase. The greatest insect enemy of the gardener is a small, dull-coloured, hairless caterpillar, known as the cut-worm, which is the larva of a Noctuid moth. This chief of the brigand band of garden pests usually hides during the day beneath matted grass or under the loose earth along the rows of plants. It comes forth at dusk to feed. The bird is abroad at the first peep of day, and it finds the robber worm in the morning before it has retreated to its place of concealment.

But the early bird has to come steathily to the garden to catch the worm. Its visits are regarded by man with more than suspicion, and it is fortunate if it escapes with its life. In consequence it snaps up a caterpillar and is off again, leaving thousands it would have eaten if unmolested, to run riot amongst the vegetables.

Occasionally a bird more bold than its fellows will visit the garden in broad daylight to dig the cut-worms out of their hiding places. Nature never having begrudged it the reward of its toil, the bird takes a few peas before leaving.

The gardener notices the damage done to his peas, and next morning is up betimes. He sees the bird running along a row of peas, stopping frequently to peck at something on the ground. There is a loud explosion, followed by a puff of smoke. The smoke slowly drifts away, to disclose a bird lying dead.

Caterpillars are not gifted with voice; if they were, they would scarce forbear to cheer.

The bird is dead. Mark the sequel. One morning the gardener issues proudly forth to cut his mammoth cabbage—the one with which he intends to put to utter confusion all other competitors at the local fruit and flower show. Alas for human hopes and the depredations of caterpillars. The cabbage is riddled like a colander.

The gardener when he shot the bird forgot, if, indeed, he ever knew, that the ancient law forbade a muzzle to the ox that threshed out the corn.

UTILITY OF BIRDS IN THE MEADOW.

Each season, until hay-making commences, the grass offers cover and shelter for the nests of such birds as breed on the ground. The fields also provide food for birds, and for the insects on which birds feed. Thus there is established a natural interrelation and interdependence between the bird and its food and shelter—that is to say, the insects and the grass. This simulates the condition of the earth before man made discord in the grand harmony of nature's laws.

Where the birds of the field are undisturbed they tend to hold the grass insects in check. On the other hand, when the numbers of birds in the field are for any reason insufficient, the insects increase.

Here is an instance of this: Some years ago in Bridgewater, Mass., a great battle was held by the ignorant townspeople in the spring of the year, and so many field birds were killed that their dead bodies were ploughed into the lands for manure. The following summer whole fields of grass withered away and died. This was due solely to the fact that her number of field birds had been reduced, and in consequence the pressure which nature demands the field birds shall exert upon the field insects had been released.

Again, at one time in New Zealand it was no uncommon thing to see English grass wither up in large patches, as though scorched by fire. This was due to the work of a crane fly and click beetle, the larvæ of both of which were addicted to the habit of eating the roots of the grass just under the surface. English grass was then comparatively limited, in the up-country districts, and, as there are large tracks of land in New Zealand destitute of native grasses, the depredations of these insects became a serious matter to those settlers who had stock to feed and who were relying on the English grass to feed it. It was all the more serious because the insects were without any natural check, the native birds which had kept them in subjection before the advent of the white man having been either killed or driven from the vicinities of the homesteads. So the beetles continued to make merry, to marry and to multiply. In the corresponding ratio the grass continued to fade, to wither and to die.

Then came the English starling, and so voraciously did it feed on the larvæ that soon all was green again.

A case similar to the foregoing, occurred about five years ago in an inland district of Australia, where, owing to the ruthless destruction of wild bird life, grubs took possession of the land, and, eating out the grass by the roots transformed what had been a rich pastural country into an unprofitable waste.

Without the aid of birds grass could not be grown. The grub of a single species of beetle, if unchecked in its multiplication, could destroy all the roots in our meadows; or any one of the several species of cutworms, if this reproduction was not restrained by birds, might be sufficient to destroy all the verdure above ground.

(To be continued).

BALATA.

BALATA LICENSES.

The following notice was published in *The Trinidad Royal Gazette* September 28, 1916:—

GOVERNMENT HOUSE,
September 15, 1916.

It is hereby notified for general information that in exercise of the powers conferred by Section 4 of the Forests Ordinance No. 42 of 1915 His Excellency the Governor in Executive Council has been pleased to prescribe the following form of license for the extraction of Gum from Balata trees growing on private land.

LICENSE TO EXTRACT GUM FROM BALATA TREES ON PRIVATE LANDS (UNDER SECTION 4 OF FORESTS ORDINANCE No. 42 OF 1915.)

License No.........

Permission is hereby granted to..
....of..
....
to extract gum from.......................Balata trees situated on an area of
...........................a.......................r......................p.
owned by..
and situated in the Ward of..............................subject to the following conditions:—

1. This license is not transferable.
2. The names of the persons who are actually to cut the Balata trees for the purpose of extracting the gum must be written on the back of this license, before the work is begun.
3. The licensee must notify the Warden in writing of the date on which the cutting of the trees is actually commenced.
4. The licensee must notify the Warden in writing of the date when the cutting of the trees is finished.
5. This license comes into force on the...
6. This license expires on the..
7. This license does not authorise the cutting of Balata trees on any land which is not in fact the property of the licensee except with the permission of the owner of such land.
8. This license must be produced by the licensee on the demand of a Forest Officer, Warden, Member of Constabulary Force or Rural Constable.
9. In the event of any breach of the conditions of this license, it may be cancelled by me the undersigned, and thereupon such license shall become void and of no effect.

Date....................................

....
Warden.

Forms of application can be obtained from the Warden.

By Command,

W. M. GORDON,
Acting Colonial Secretary.

(No. 229.)

GOVERNMENT LABORATORY.

GOVERNMENT LABORATORY FEES.

Revised Scale of Fees to be paid into the Colonial Treasury for the Examination of Samples sent to the Government Laboratory by private persons, to commence on October, 1916.

A.—WATERS.

1.	Partial quantitative analysis, with an opinion as to fitness for drinking purposes	$ 5 00
2.	Complete quantitative analysis for the purpose of ascertaining fitness for drinking, domestic, agricultural or manufacturing purposes	10 00
3.	Complete quantitative analysis, including an analysis of the dissolved salts and gases	24 00
4.	Determination of chlorine or salt	1 00
5.	Determination of temporary and permanent hardness ...	1 50
6.	Preliminary opinion as to quality	1 00

Each additional sample received at the same time will be charged half the above fees.

B.—SOILS AND MANURES.

7.	Determination of one constituent (total or available) ...	2 00
8.	Determination of each additional constituent (total or available)	1 00
9.	General chemical analysis of a soil or clay	10 00
10.	Complete chemical and mechanical analysis of a soil or clay	20 00
11.	Commercial analysis of guano, sheep or other animal manure, ammonia salts, soda salts, potash salts, gypsum, dried blood superphosphates, bones, fish manures, bone black, bone ash, ash, mineral phosphates, slag phosphates and precipitated phosphates	5 00
12.	Complete analysis of mixed artificial manure, guano, sheep and other animal manure, with an estimate of value ...	10 00

C.—LIME, MARLS, &c.

13.	Determination of lime in a lime or marl	2 50
14.	Determination of lime as oxide or hydrate and as carbonate in a lime	4 00
15.	General chemical analysis of a lime or marl	5 00
16.	,, ,, cement...	10 00

D.—FEEDING STUFFS.

17.	Determination of one constituent	2 00
18.	,, each additional constituent	1 00
19.	,, oil and albuminoids in coconut cake or meal	1 00
20.	Commercial analysis of any oil-cake or other substance used for feeding purposes	5 00

E.—SUGARS AND SUGAR PRODUCTS.

21.	Ordinary polariscopic test of sugar or molasses	$ 1 00
22.	Determination of total sugar expressed as glucose in molasses, cane juice, wash, &c.	2 00
23.	Determination of sucrose and glucose in molasses, cane, cane juice, &c.	3 00
24.	General chemical analysis of sugar or molasses	6 00
25.	Complete „ „ „	10 00

F.—FOOD AND DRINK.

26.	Tea, flour, coffee, cocoa, chocolate, mustard, pepper, ginger, butter, ghee, cheese, lard, condensed milk, etc.	7 50
27.	Estimation of fat in butter, ghee, cheese or lard, cocoa, chocolate	2 50
28.	Milk	2 50
29.	Beer, wine, spirit, and other fermented liquors	15 00
30.	Wines, beers, or temperance beverages, for percentage of proof spirit only	2 50
31.	Hydrometer strength of rum or plain spirit	50
32.	Obscured strength of rum, brandy, etc.	3 00
33.	Quantitative examination of aerated waters for ordinary metallic impurities	2 00
34.	Beer for original gravity	5 00

N.B.—A special charge will be made for analysis for any sample connected with proceedings for infringement of trade marks, etc.

For samples taken with a view of obtaining a preliminary opinion (for information only of purchasers or vendors of food and drugs) as to whether any article of food or any drug is genuine or adulterated, the following special fees will be charged:—

35.	Preliminary opinion founded on a simple analysis of milk	50
36.	Preliminary opinion founded on a simple analysis of any other substance	1 00

G.—DRUGS AND CHEMICALS, &c.

37.	Analysis for purity, etc., of any drug	10 00
38.	„ „ „ chemicals	5 00
39.	Turpentine substitutes	5 00
40.	Mineral oils mixed with other oils	5 00

H.—ORES AND MINERALS.

41.	Qualitative examination of mineral	$3 00 to 5 00
42.	Assay of quartz for gold	10 00
43.	General chemical analysis of any mineral	20 00

Asphaltic Substances.

44.	Determination of one constituent	2 00
45.	„ each additional constituent	1 00
46.	Melting point	1 00
47.	Specific gravity	1 00
48.	Commercial analysis	5 00

MINERAL OIL.

49.	Flash point of crude petroleum or other oil	$ 1 00
50.	„ Dangerous petroleum not previously so described	2 50
50A.	Flash point of Petroleum under 96° F. (Regulation 49; Ordinance No. 20 of 1915)	4 80
51.	Determination of one constituent by fractional distillation	2 00
52.	Determination of each additional constituent by fractional distillation	1 00
53.	Specific gravity	1 00
54.	Estimation of sulphur	3 00
55.	Distillation in bulk exceeding 200 cubic centimetres for the separation of fractions for further analysis; an additional fee of	$5 00 to 10 00
56.	Dehydration of an oil	2 00
57.	Estimation of water	2 00
58.	„ paraffin wax	3 00
59.	Viscosity at 32° F.	5 00
60.	„ 60° F. or air temperature	2 00
61.	Commercial analysis of mineral lubricating oil	$5 00 to 10 00
62.	Determination of coefficient of expansion	2 00

COAL, LIGNITE, GRAPHITE.

63.	Coal, or lignite commercial analysis	7 50
64.	Coal or lignite, calorific value	5 00
65.	Graphite	7 50

I.—TOXICOLOGICAL EXAMINATION.

66.	Suspected poisonous substance, unmixed	7 50
67.	„ „ mixed with food or drink	15 00
68.	Suspected poisonous substance, mixed with stomach contents or other animal matter	20 00

J.—MEDICAL ANALYSIS.

69.	Diabetic urine for sugar, quantitative	50
70.	Albuminous urine for albumen, quantitative	50
71.	Complete chemical analysis of urine	10 00
72.	Microscopical analysis of urine	5 00
73.	Urine for urea, quantitative	1 00
74.	„ uric acid	3 00

K.—MISCELLANEOUS.

Any article to which the foregoing scale is not applicable will be charged as follows:—

75.	Determination of one constituent only	3 00
76.	„ each additional constituent	2 00
77.	Complete general analysis	20 00
78.	Comparison of Sykes' Hydrometer with standard Laboratory Hydrometer	2 50

Attendance at Court is not included in the above fees.

L.—APPARATUS AND CHEMICALS.

Small quantities of chemicals and glass apparatus may be purchased at the Government Laboratory under the following conditions:—

(a.) They must be required for the advancement of some matter of agricultural or commercial interest in the Colony.

(b.) They shall only be supplied when it is impossible to obtain them locally, and when required urgently.

(c.) All such applications must be sent through the Honourable the Colonial Secretary.

By Command,

W. M. GORDON,
Acting Colonial Secretary.

Government House,
September 25, 1916.—(No. 234).

Scale of Fees.

His Excellency the Governor has been pleased to prescribe under Section 17 of Ordinance No. 162, the following Scale of Fees to be paid into the Colonial Treasury, for the analysis of samples of Food and Drugs purchased by private persons and delivered to the Government Analyst in accordance with Section 21 of that Ordinance:—

A.—Milk...	$1 00 each.
B.—Butter, lard, ghee, vinegar, rum, coconut oil, olive oil	2 00 ,,
C.—Any article of food or drink other than those above enumerated, or any simple drug	3 00 ,,

Section 21 of Ordinance No. 162:

"Any purchaser or persons other than a functionary, and any functionary "purchasing any article of food or drug or demanding to purchase any article "of food or drug under the provisions of this Ordinance with the intention of "submitting the same to analysis shall, if the seller or his agent or his servant "demand it but not otherwise, then and there divide the article of food or "drug in the presence of such seller, agent or servant, into three parts.

"He shall cause each of such parts to be marked and sealed or otherwise "fastened up in such a manner as the nature of such article of food or drug "will permit.

"He shall thereupon deliver one of such parts to the seller or his agent "or leave the same upon the premises wherein the purchase shall have been "made.

"He shall retain one other part for future comparison or verification and "shall submit the third part to the Analyst for analysis.

"If no such demand as hereinbefore provided is made by the seller, his "agent or servant, the Analyst receiving the article for analysis shall divide "the same into two parts and shall seal or fasten up one of those parts and "shall cause it to be delivered at or before the time when he supplies his "certificate to the purchaser who shall retain the same for production in case "proceedings be taken in the matter."

By Command,

W. M. GORDON,
Acting Colonial Secretary.

Government House,
September 25, 1916.—(No. 235.)

METEOROLOGY.

RAINFALL RETURN FOR 12 MONTHS ENDING DECEMBER, 1916.

Stations.	October, 1916.	November, 1916.	December, 1916.	Jany. to Dec., 1915.	Jany. to Dec., 1916.
North-west District.	Ins.	Ins.	Ins.	Ins.	Ins.
St. Clair—Royal Botanic Gardens	6·68	9·32	1·98	56·31	69·73
Port-of-Spain—Colonial Hospital	7·03	9·06	·99	42·48	53·70
,, Royal Gaol	6·99	9·13	1·36	50·11	57·98
,, Constabulary Headquarters	9·74	8·27	1·31	31·88	60·45
St. Ann's—Reservoir	8·02	11·09	1·42	63·15	75·17
Maraval— ,,	9·62	8·96	2·78	64·43	84·08
,, Constabulary Station	9·26	8·25	3·08	77·93	83·49
Diego Martin—Constabulary Station	8·37	11·56	3·08	69·55	84·80
,, Waterworks	7·61	9·49	3·33	66·03	75·62
,, River estate	7·29	9·37	3·23	67·13	74·32
Fort George Signal Station	6·10	8·68	2·29	61·29	71·40
North Post ,,	4·06	7·00	3·24	58·91	61·54
Carenage Constabulary Station	8·81	16·04	1·80	69·98	88·82
Carrera Island Convict Depôt	5·89	9·49	2·07	44·71	55·47
Chacachacare Lighthouse	4·87	9·58	1·87	45·48	45·68
Santa Cruz—Maracas District.					
Santa Cruz—Constabulary Station	6·37	8·02	3·74	64·43	88·35
St. Joseph—Government Farm	6·81	7·12	·73	57·20	53·83
,, Constabulary Station	7·49	7·78	·76	40·39	48·62
Tunapuna—St. Augustine estate	7·49	8·08	·53	53·67	50·12
Maracas—Government School	7·18	8·52	4·46	60·24	89·21
,, Ortinola estate	7·08	9·55	3·48	61·73	81·16
Caura—Wardour estate	4·80	7·38	1·88	54·86	64·65
West Central District.					
Caroni—Frederick estate	5·37	9·91	·99	66·91	55·66
Chaguanas—Constabulary Station	7·69	9·89	1·89	67·17	56·13
,, Woodford Lodge estate	6·78	9·60	2·08	64·22	55·85
Carapichaima—Waterloo estate	10·45	11·29	1·41	61·98	66·04
,, Friendship Hall estate	4·86	Nil	Nil	71·88	39·36
Couva—Exchange estate	4·46	9·11	·95	58·96	53·61
,, Brechin Castle estate	6·84	9·38	·81	60·29	63·68
,, Perseverance ,,	6·67	10·68	·81	56·29	58·82
,, Camden ,,	5·16	7·98	1·21	56·39	50·86
,, Milton ,,	7·29	10·17	1·87	67·35	71·64
,, Spring ,,	5·91	9·83	1·93	69·14	62·21
,, Constabulary Station	6·08	8·28	·63	58·41	59·65
,, Esperanza estate, Savonetta	5·24	7·67	·52	61·01	60·83
Montserrat District.					
Montserrat Cônstabulary Station	7·47	6·97	2·65	69·58	62·83
Brasso—La Vega estate	8·71	13·05	2·75	91·68	76·70
Santa Clara Estate	8·60	12·26	3·59	...	85·22
Arima District.					
Arima—Warden's Office	8·92	8·71	1·88	58·46	63·95
,, Torrecilla estate	7·11	14·07	2·52	78·25	80·05
,, Verdant Vale estate	5·52	12·79	2·31	78·81	84·59
San Rafael—Constabulary Station	9·62	17·84	4·22	92·86	81·24
Guanapo—Talparo estate	8·35	13·53	3·35	93·63	75·13
,, San José Estate	10·90	16·60	3·65	96·14	95·24
Tamana—Sta. Marta estate	11·22	16·64	5·49	98·61	102·38
,, La Corona estate	12·60	20·83	5·28	...	119·47
San Fernando & Princes Town District.					
Claxton's Bay—Forres Park estate	7·75	8·37	1·05	56·48	65·28
Pointe-à-Pierre—Bonne Aventure est.	4·14	8·77	2·40	64·32	59·39
,, Concord estate	4·34	9·76	2·19	69·86	61·41
,, Plein Palais estate	5·76	7·00	1·77	58·41	53·87
Naparima—Picton estate	9·29	6·57	3·01	64·36	62·00
,, Usine St. Madeleine	5·08	5·98	2·29	62·13	59·65
,, La Fortunée estate	6·90	6·32	2·20	57·77	56·67

RAINFALL RETURN FOR 12 MONTHS ENDING DECEMBER, 1916.—CONTD.

Stations.	October, 1916.	November, 1916.	December, 1916.	Jan. to Dec., 1915.	Jan. to Dec., 1916.
San Fernando and Princes Town District.—(Cont'd.)	Ins.	Ins.	Ins.	Ins.	Ins.
Naparima—Lewisville	5·89	6·15	2·16	70·57	69·41
,, Tarouba estate	5·27	5·29	·60	48·04	44·47
,, Union Hall ,,	5·04	6·11	2·10	52·58	58·78
,, Palmiste ,,	7·98	9·14	2·10	67·79	66·60
,, Hermitage ,,	9·16	6·06	2·47	59·98	55·69
Princes Town—Craignish ,,	6·51	7·70	3·99	70·14	65·95
,, Cedar Hill estate	4·91	6·45	2·68	67·70	61·83
,, Williamsville estate	5·40	7·75	4·28	77·33	70·54
,, Esmeralda estate	6·85	9·07	3·06	76·32	64·91
,, New Grant estate	6·18	7·94	4·98	84·99	71·27
,, Constabulary Station	5·00	6·54	3·19	46·95	58·71
,, Hindustan estate	5·77	6·85	1·26	74·24	70·01
,, La Retraite estate	8·16	9·96	6·14	91·26	99·38
,, Malgretoute estate	5·87	7·13	3·41	76·73	69·79
Savana Grande—Friendship & Ben Lomond estates	7·77	6·15	3·20	68·06	68·80
Poole—El Rosario estate	7·42	11·83	5·91	98·26	89·58
Petit Morne estate	5·48	5·36	2·35	...	56·10
South-west District.					
Oropuche—Constabulary Station	9·57	6·13	3·05	70·74	62·96
,, Pluck estate	8·45	5·44	2·65	63·92	59·17
Siparia—Constabulary Station	8·91	6·59	4·29	90·77	62·98
,, Alta Gracia estate	8·58	6·71	4·14	71·62	68·82
Guapo—Adventure estate	4·84	6·87	3·58	60·47	64·11
Cap-de-Ville—Constabulary Station	5·40	9·51	4·34	74·03	78·29
Erin—La Ressource estate	4·79	4·46	4·62	55·20	45·29
,, Industry estate	6·21	6·50	4·22	61·04	55·68
Cedros—La Retraite estate	4·31	10·19	3·38	63·93	84·49
,, Constabulary Station	5·53	6·05	4·45	49·26	59·24
,, Beaulieu estate	6·94	4·15	3·61	41·61	56·48
,, Perseverance estate	5·91	5·45	4·16	49·06	59·15
,, St. Marie estate	3·80	5·27	4·70	45·40	56·76
Icacos—Constance estate	9·81	4·89	6·17	42·68	76·22
Irois—Government School	3·18	8·92	3·89	55·69	72·01
South Coast.					
Moruga—Constabulary Station	9·96	7·75	6·47	62·41	75·96
East Coast.					
Matura—La Juanita estate	6·43	11·57	3·12	101·00	82·85
Manzanilla—Constabulary Station	11·45	14·42	6·59	98·57	88·40
Sangre Grande—San Hilario estate	9·51	13·43	3·26	...	81·59
,, New Lands estate	6·24	15·17	5·68	95·08	88·94
,, Evasdale estate	10·15	18·14	5·95	100·36	98·39
,, Grosvenor estate	9·94	19·74	6·95	108·57	99·42
Mayaro—Constabulary Station	10·34	10·23	5·01	72·29	85·02
North Coast.					
Blanchisseuse—Constabulary Station	6·45	16·43	6·77	65·15	85·51
Grande Rivière—Mon Plaisir estate	8·70	19·16	7·89	89·62	108·49
Toco—Aragua House	9·23	14·90	7·19	74·84	88·46
,, Constabulary Station	6·28	13·05	7·74	68·63	75·76
Point Galera—Light House	2·99	6·34	6·11	54·32	53·66
Tobago.					
Tobago—Hermitage estate	17·02	14·99	4·33	89·08	103·82
,, Riversdale ,,	12·52	12·00	4·20	60·18	83·12
,, King's Bay ,,	15·67	11·65	4·25	84·37	95·04
,, Roxburgh	19·08	12·51	6·34	104·97	109·23
,, Lure estate	21·50	13·89	6·32	99·15	99·86
,, Botanic Station	16·04	12·41	2·11	73·44	76·30
,, Government Farm	11·46	9·86	1·20	54·05	57·83
,, Lowlands estate	18·13	11·13	1·91	66·74	70·73
,, Friendship estate	13·69	10·66	1·27	76·56	65·13
,, Bon Accord estate	11·34	9·51	·93	65·68	56·67

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THE FOOD SUPPLY OF THE COLONY. (1)

By W. G. FREEMAN,
Acting Director of Agriculture, Chairman Ground Provisions Committee.

THE World's War has resulted in many and far reaching changes in the production and distribution of commercial products. For the inhabitants of many countries the most important of these changes is the actual or threatened interference with their food-supply. In Europe itself the maintenance of the food-supply is one of the most serious engaging the attention of the Governments. Famine, through all the ages, has been one of the chief forces in compelling the surrender of the besieged and is none the less effective whether these be a whole country or group of countries, or merely an isolated town or army. On both sides we see at the present time every effort being made to prevent food supplies from reaching enemy countries ; in consequence all are forced to increase, by every means in their power, their production of essential articles, and by means of State control to ensure proper distribution and to guard against waste.

THE KING'S PROCLAMATION.

The seriousness of the problem in the United Kingdom is shown by the Proclamation of His Majesty the King:—

"WE, being persuaded that the abstention from all unnecessary consumption of grain will furnish the surest and most effectual means of defeating the devices of our enemies and thereby bringing the War to a speedy and successful termination, and out of our resolve to leave nothing undone which can contribute to those ends or to the welfare of our people in these times of grave stress and anxiety, have thought fit, by and with the advice of our Privy Council, to issue this our Royal Proclamation, most earnestly exhorting and charging all those of our loving subjects, the men and women of our Realm, who have the means to procure articles of food other than wheat and corn as they tender their immediate interest and feel for the want of others, especially to practice the greatest economy and frugality in the use of every species of grain and wheat. And WE do for this purpose more particularly exhort and charge all heads of households to reduce the consumption of bread in their respective families by at least one-fourth of the quantity consumed in ordinary times, to abstain from the use of flour in pastry, and moreover, carefully to restrict, or wherever possible to abandon the use thereof in all articles other than

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(1.) An address delivered at the distribution, by His Excellency the Governor, of the prizes in the Cacao Prize Competition, at San Fernando, July 28, 1917.

bread. And WE do also in like manner exhort and charge all persons who keep horses to abandon the practice of feeding the same with oats or other grain unless they shall have received from our Food Controller a license to feed horses on oats and other grain, to be given only in cases where it is necessary to do so with a view to maintain the breed of horses in the national interest, and WE do hereby further charge and enjoin all ministers of religion in their respective churches and chapels within our United Kingdom of Great Britain and Ireland to read or cause to be read this our Proclamation on the Lord's Day for four consecutive weeks after the issue thereof."

CAUSES OF THE WORLD'S SHORTAGE.

The food crisis is not confined to the countries actually within the area in which hostilities are taking place. It is world wide, due to a variety of causes which are well summarised in the following extract from an interesting article by Dr. A. Shadwell in the *Nineteenth Century* for April, 1917.

"War needs and operations have increased consumption, brought Governments into the market and depleted supplies, thus causing an intense competition for food between nations, departments, civil and military populations, and between individuals. At the same time they have increased the cost of production and distribution all round and flooded the country with money drawn from past accumulations and mortgages on the future. An exceptionally bad harvest last year accentuated these conditions, and the intensified submarine war recently inaugurated has tightened the screw. Here are the real explanations of the present situation."

THE SUPPLY OF CEREALS.

Further evidence, particularly with regard to the shortage in cereals, is afforded by a report of the International Institute of Agriculture, a summary of which appeared in *Nature* for May 24, 1917 (Vol. 99, p. 253):

"The recently published 'Statistical Notes on Cereals' (No. 5, March, 1917), issued by the International Institute of Agriculture must be regarded in the existing situation as a compilation of more than ordinary interest, representing as it does the most precise information obtainable as to the results of last season's corn harvests throughout the world. Preliminary estimates issued from time to time have pointed with lamentable uniformity to a serious shortage of corn supplies as compared with recent years, and the final record fully bears them out. Interest centres specially in the yield of cereals available for international trade, which excludes enemy countries, territories invaded by the enemy, and countries such as the uninvaded portions of Rumania and European Russia, export from which is prevented by the war. The total yield of wheat from all other sources shows a decline of 27·7 per cent. as compared with the excellent harvest of 1915, and 16·9 per cent. as compared with the average of the five seasons 1911–15. The rye crop shows corresponding deficiencies of 2·9 per cent. and 4·1 per cent.; barley, 9·9 per cent. and 4·1 per cent.; oats, 6·9 per cent. and 3·2 per cent.; and maize, 15·9 per cent. and 12·1 per cent. respectively. Taking wheat and rye together as the staple bread-corn crops, the total deficiency as compared with 1915–16 is 26·3 per cent., or 16·1 per cent. below the five-year average, whilst the total of the three "fodder-corn" crops shows corresponding deficiencies of 15·5 per cent. and 8·8 per cent. respectively. Now that all corn has become bread-corn the grand total is of interest, and this shows deficiencies of 19·6 per cent. and 11·4 per cent. respectively.

"In order to get a true picture of the balance between production and consumption it is necessary, however, to bring further into the account the 'carry-over' from previous seasons' crops, which fortunately in the case of wheat, oats, and maize was large. Even then, however, the available supplies fall short of estimated normal consumption for every crop except oats. In the case of wheat the whole supply of crop and reserve fails to meet normal consumption by roughly 2 per cent., whilst the total supplies of grain of all kinds show a deficiency below consumption requirements of fully 3 per cent. These deficiencies may appear to be small, but it must be remembered they involve the entire consumption of the remainder left on hand from the superb crop of 1915 and leave absolutely no margin of insurance against a further unfavourable crop in the current season When we make allowance further for the large quantities of corn which must have been lost on the high seas, it must be admitted that the case for a drastic reduction in cereal consumption has been proved beyond challenge."

FOOD IMPORTS—TRINIDAD AND TOBAGO.

The effects of these influences are felt in all countries to a greater or less degree according to the extent to which they are dependent on over-sea trade for their supplies of food. It has often been pointed out to what a large extent we rely in Trinidad and Tobago on imported food not only flour and other products which cannot be produced locally, but also rice, yams, potatoes, beans, peas, plantains, etc., which could easily be grown locally in much larger quantities, and edible oils and fats for which also local products could be largely substituted. The quantities and values of the chief of these imports for 1916 are as follows:—

	Quantity.	*Value.*
Flour and Grain:		
Flour ...	285,394 barrels	£ 357,326
Meal not wheaten...	9,374 barrels	9,032
Corn and Oats	10,062,355 lb.	41,003
Rice ...	23,732,305 lb.	184,211
Dhal ...	2,398,304 lb.	18,135
Pulse ...	948,764 lb.	8,448
Cattle Food	8,031,280 lb.	36,261
Coffee ...	297,546 lb.	6,805
Oils and Fats		
Edible oils	38,632 gals.	13,807
Coconut oil	7,547 gals.	1,360
Butter	781,050 lb.	51,709
Lard ...	2,479,343 lb.	59,923
Oleomargarine	78,217 lb.	2,094
Vegetables, fresh		40,998
		£ 831,122

These imports, of the total value of £831,122 could be largely reduced by the local production of some of the products or by the use of locally grown substitutes.

In normal times an agricultural community must decide for itself which is the most profitable course to pursue. If it be more remunerative to devote attention chiefly to cacao, sugar, etc., for export, and to purchase yams, potatoes, rice, etc., from outside, this course can be taken without danger. At present however we are not equally free agents to take whichever course we may prefer. Flour, of which such large quantities are used, is already very dear and with the always present possibility of a poor harvest and the varying chances of war, may become still dearer and possibly obtainable only in reduced amount. In either case flour may well prove to be too expensive for use by a large section of the population on the same scale as hitherto. British Guiana has already placed restrictions on the export of rice. These may be raised with the harvesting of the next crop, but the ordinary supplies cannot be counted on with certainty. The same consideration applies to the supplies of yams, sweet potatoes usually received from neighbouring islands. Barbados has placed an absolute prohibition on the export of foodstuffs, and whether it be withdrawn or not depends entirely on the course of events. St. Vincent and Grenada are pursuing the same policy of safeguarding their own supplies.

From the early days of the war it was evident that the proper course for the Colony to pursue was to produce as far as possible its own foodsupplies. In an appeal to the people of the Colony, issued by the Ground Provisions Committee in the local press on September 1, 1914, and reprinted in this *Bulletin* (XIII, 1914—pp. 251-3) the necessity of every one becoming if possible a producer instead of only a consumer of food was urged, and suggestions made as to how this might be accomplished. Large areas of land were then offered, in many cases free of charge, by private owners. The Government also threw open certain Crown Lands at the purely nominal rental of one shilling per annum for a period of two years, with the option of renewal for a further one or two years. By October, 1914, 402 acres had been so taken up by 246 people. Much other planting was done, but as, excepting a short rise at first, prices kept fairly normal, planting was not undertaken on as large a scale as had been hoped.

LOCAL INCREASE IN PRICE OF FOODS.

Since 1914, however, the pressure of increasing prices of imported foods has made itself felt. The extent of this increase is seen by comparing the official scheduled prices of the principal foodstuffs in shops within two miles of a railway station or coastal service depôt in August, 1914 and July, 1917:

	August 1914.	July 1917.	Increase in price.
Biscuits (Middies) not less than	5 for 1 cent...	7 for 2 cents	43 per cent.
Bread not less than	3 oz. for 1 cent	2 oz. for 1 cent	50 ,,
Corn Meal not more than	4 cts. per lb.	6 cts. per lb.	50 ,,
Rice, (white)	5 cts. ,,	8 cts. ,,	60 ,,
Rice, (brown)	...	7 cts. ,,	
Flour	5 cts. ,,	7 cts. ,,	40 ,,
Lard substitute	16 cts. ,,	24 cts. ,,	50 ,,
Oleomargarine	14 cts. ,,	20 cts. ,,	43 ,,
Sugar, (No. 2 Usine)	4 cts. ,,	6 cts. ,,	50 ,,
Sugar, (Molasses or Muscovado)	4 cts. ,,	5 cts. ,,	25 ,,
Split peas	4 cts. ,,	6 cts. ,,	50 ,,
Dhal	4 cts. ,,	6 cts. ,,	50 ,,

INCREASED LOCAL PRODUCTION.

One effect of the increased prices of foods is seen in the greatly increased acreage of Crown lands rented for provision growing this year. Returns sent in by the Wardens, show that there are 1,455 acres now rented compared 402 at the end of 1914 and applications are still being received. The areas now taken up are distributed as follows:—

Ward Union.	*Total.*
Arima	512
Chaguanas	5
Couva	2
Diego Martin	82
La Brea and Oropuche...	24
Montserrat	100
Naparima	3½
Savana Grande and Moruga	476½
Tacarigua	247
Toco	2
Tobago	1
	1,455 acres.

This return does not represent by any means the total additional area devoted to ground provisions this year. On several estates much planting has been done, either by the proprietors, or by labourers to whom land has been offered free. In some wards also *e.g.* Toco and Tobago where there are practically no Crown Lands taken up under this scheme, the reason is that the people are largely peasant proprietors and have sufficient land already. Both Toco and Tobago are large producers of ground provisions.

In the case of Tobago, owing to its being an island and sending its supplies of provisions to Trinidad, it is possible to obtain figures showing how the trade in these products has increased during the war.

1913–14	£ 3,126
1914–15	4,548
1915 (9 months)	8,380
1916	10,274

It is impossible to show similar statistics for different parts of Trinidad, but that in many districts the necessity for increased production of food crops has been realized is evident. Areas in ground provisions ranging in size from a small patch of yams, corn and beans, around a labourer's hut to large fields of sweet potatoes, corn, etc. on an estate, are to be seen on every side, and in the cacao districts there are, as always, large supplies of tannias, bananas, etc., in the young cultivation. Much more however could still be done.

The Board of Agriculture has instituted vegetable prize competitions in Trinidad and Tobago and another for rice growing in Trinidad for which seed paddy has been imported from British Guiana. The Board has also approved of its five Agricultural Advisers devoting the greater part of their time this year to encouraging the production of food crops.

UTILISATION OF LOCAL SUPPLIES.

It now remains to make the best possible use of the increased crops which are being raised. For the householder, cultivating a small area for the use of himself and his family, local foodstuffs should be used in preference to imported as far as possible. The use of bread can be reduced by the increased use of yams, potatoes, etc.; the more perishable vegetables themselves can be dried and stored for future use, and from some of them meals can be made which can be employed as flour substitutes. Separate reports on the preparation of dried vegetables, meals and their use as flour substitutes follow; they give the results of experimental work both in this Colony and in British Guiana. Coconut butter and coconut oil can similarly largely replace imported butter and lard for both eating and cooking purposes; directions for making coconut butter and oil are given (p. 83).

Stress has been laid ever since 1914 on the importance of every household, as far as is practicable, doing something to produce food for its own use, and during this year in particular on the use of locally produced meals as flour substitutes, in the event of a scarcity or still further rise in the price of flour. Since the beginning of this year meetings have been addressed in various parts of the Colony, *e.g.* Port-of-Spain (Board of Agriculture, Agricultural Society and Horticultural Club), Toco, Rio Claro, St. Joseph, Chaguanas (East Indian National Congress), Princes Town, Arima and Blanchisseuse in Trinidad, Scarborough and Roxburgh in Tobago at which I have directed attention to the certain increase of prices, to the threatened shortage, the need for economy in use of imported products, and the duty of every one to become as far as possible self-supporting. Attention was also directed to the same question at the Port-of-Spain Agricultural Exhibition in March this year, by means of (1) exhibits of the actual quantities of flour, rice, beans, peas, etc. imported for each adult of the population in a year (2) a practical demonstration of what could be grown on a little plot of land such as is possible for anyone having only a small garden. From a plot 100 feet by 25 feet, there should be obtained in a year, with good cultivation, 500 lb. of yams, 250 lb. of sweet potatoes, 180 lb. of tannias, 180 lb. of cassava, 80 lb. of corn as well as some miscellaneous vegetables such as tomatoes, cabbage.

In the following pages information is given on the cultivation and uses of the more important vegetables, and also on the preparation of coconut butter and oil. It is hoped that these notes will be of assistance to those who are endeavouring to produce and use local foodstuffs.

The interests are also being looked after of those who have planted provisions to sell and those who through force of circumstances, *e.g.* town dwellers, must be dependent in great measure on purchased supplies. This work has been entrusted by His Excellency the Governor to the Ground-Provisions Committee whose proposals follow:—

PROPOSALS OF THE GROUND PROVISIONS COMMITTEE.

Establishment of a Government Depot.

The Ground Provisions Committee, composed of W. G. Freeman, Acting Director of Agriculture (Chairman), Hon. Sir N. Lamont, Bart., Hon. W. G. Kay, Hon. A. Smith, A. B. Carr, and E. M. Lazare has made proposals as to steps to be taken regarding the production and distribution of locally grown foodstuffs. The following is a summary of the proposals, approved by His Excellency the Governor:—

(1.) A Government Depôt for the purchase and sale of ground provisions will be established near the Light House Jetty and Railway Station, Port-of-Spain, the present Drawback Shed being temporarily used for the purpose.

(2.) The produce dealt with will be yams, sweet potatoes, tanias, eddoes, dasheen, cassava, plantains, bananas, dry beans and peas, corn, rice, pumpkins, meals and starches.

(3.) Business at the Depôt will be wholesale only, *i.e.* in quantities, for ordinary ground provisions, of say 28 lb. and over, and retail business, if found desirable, will be done by taking stall-space in the City Market, and by co-operation with the Home Industries Association.

(4.) Mr. J. Beard, Junior Agricultural Instructor, Education Department, has been seconded to be Manager of the Depôt.

(5.) Produce may be delivered at the Depôt by cart, etc., or way-billed in marked bags from Railway Stations and the Railway and Royal Mail Steam Packet Company Depôts, and paid for, from cash to be sent to the station collectors, or depôt keepers, on presentation of a way-bill sent to the seller.

(6.) Produce can be sent by any train, but there will be a special provision van on two fixed days each week, on each of the three main branches of the Railway.

(7.) Information regarding the Government Depôt and its work will be given by the liberal use of posters, and by endeavouring to secure the co-operation of Managers of estates in the collection and forwarding of produce. The assistance of the Wardens and their Ward Officers will also be requested in giving information to the cultivators amongst whom they travel.

(8.) The authorities of the large estates will be asked to impress on their labourers, farmers, etc., the importance of growing provisions, and to give all possible facilities.

(9.) Arrangements have already been sanctioned for the five Agricultural Advisers of the Board of Agriculture devoting their time to the encouragement of provision growing. They will also assist, as found desirable, in its collection.

(10.) The Education Department, it is suggested, should devote school gardens to ground provisions and where necessary, by co-operation with the Department of Agriculture, use the gardens as nurseries for the supply of seeds, slips, etc.

(11.) The Home Industries Association is desirous of opening a branch for the sale of fruit, vegetables and ground provisions. As this might develop into place of shopping for ladies and others who do not go to the market, the proposal is worthy of encouragement, and the Depot will co-operate with the Association in developing this branch of its work.

(12.) It is suggested that the Board of Agriculture send a circular letter to estates, urging the need of provision growing, and asking them to report what action is being taken, what area planted, and also to give any possible help as in (7).

NOTES ON THE CULTIVATION OF VEGETABLES.

These notes have been drawn up by Mr. R. O. Williams in consultation with Messrs. L. Seheult, B.Sc., and W. E. Broadway.—[W.G.F.]

General.

Select a good open piece of ground, fork it deeply, break the soil up fine and at the same time work in what manure, wood ashes or vegetable refuse there may be at hand. It is very necessary, if good crops are to be continuously gathered from the same ground, that the soil be contantly replenished in food material. Mulching or covering the soil with a layer of grass, manure or some such material is also very beneficial particularly during dry weather, as it prevents the rapid loss of moisture from the soil. Constant working of the surface soil, especially after showers of rain, by means of a hoe or cultivator has the same effect. If this system of mulching or hoeing be thoroughly practised, much time, labour and expense in watering can be saved.

Vegetables are best grown on raised beds, about four feet in width with a narrow path between. This assists in draining the beds and facilitates the working of the soil.

A necessary point in the growing of vegetables, and one that should be systematically practised is rotation; it generally being advisable to plan out in advance what crops shall succeed each other. The growing on the same piece of ground of one kind of crop year after year, tends to impoverish the soil of the particular food required by that plant, and does much harm in assisting the spread of disease and insect pests. Land from which diseased plants are taken should be planted with an entirely different crop.

Yams.

Yams form a most important food in the tropics, being largely used as a substitute for potatoes. They are prolific bearers and yield large crops of tubers if grown under suitable conditions.

The best method of cultivation is to open trenches two feet wide and eighteen inches deep, at a distance of four feet apart. Fork the bottoms of the trenches and fill them up with a mixture of old manure, and decayed vegetable refuse, leaves, etc., then put the soil dug out of the trenches on top of the manure, etc., so as to form banks about fifteen or eighteen inches high. Trenches dug at least two months before planting, may be filled with raw manure, but this must not be done when they are to be planted immediately. Plant the yams in these banks at two feet apart, placing pieces of dry branches, bamboo or other support for the vines to climb on. Keep the ground clean of weeds and earth up after heavy rains.

Yam plants are prepared from (1) the yam heads or upper portions of the tubers (2) small yams or (3) the large yam cut lengthwise and then across into pieces about three to four inches square. Dry the cut surface or cover with ashes, placing it uppermost when planting.

The best time for planting is in April or May just before the rains. The yam plants may be planted direct on to the ridges, or if the trenches are not ready may be started into growth in a bed of good rich soil, transplanting them as they begin to grow. The crop will take about nine months to mature. After digging the yams store them in a dark, airy room, and they will keep for several months. If any portions are decayed cut them out and cover the surface with white lime.

Another method of planting yams, and one commonly in practice is to dig holes at a distance of 4 feet by 4 feet and eighteen inches in depth, filling and ridging them as advised for banks.

The best yams for planting are the Barbados white, Lisbon, Horn, Guinea and the Chinese or potato yam.

SWEET POTATOES.

The land on which sweet potatoes are to be grown should be deeply forked or ploughed, and the soil well pulverised. Line off 3 feet apart and bank the soil up in ridges about 18 inches high. Cuttings or slips, made from good stout pieces of stem, about twelve inches in length and from which the leaves have been removed are then inserted in the soil about one foot apart burying them to about half their length. Keep the ground weeded and repair any damage done to the banks by heavy rains. Plant the first batch at the beginning of the rainy season and the crop will be fit for harvesting in three or four months, later plantings can be made to keep up a succession; the best crops often being reaped from the September and October plantings. The tubers of sweet potatoes vary both in size, shape and flavour; the principal kinds are the red and the white. As with other crops it is not advisable to grow sweet potatoes continuously on the same land, the better system, and the one producing heavier returns, being to rotate them with some other crop.

Beans can be grown on the sides of potato or yam banks as they ripen early and do not interfere with the main crop.

TANNIAS.

The ideal tannia soil is a rich black or red loam. Tannias thrive and yield best on rich hillside land in a moist situation. They do not do well on a wet and stiff clay. On sandy river banks, when not too dry and poor, they yield a good crop. Tannias will not grow under shade. Of the many varieties the "Mock" is the most useful and prolific; the "Button" suits the poorer sort of soil and stiff clays but is neither a heavy bearer nor desirable as a marketable tannia.

When grown on suitable virgin soil the tannia plant does not need much cultivation; keep free from weeds and earth up at each weeding is, as a rule, sufficient to develop a profitable crop. When the conditions of soil and climate are not of the best then thorough cultivation of the soil is essential: draining of the soil if water-logged and subsequent forking, manuring and breaking up of the soil are indispensable. The application of an over abundance of pen manure should be guarded against, as luxuriance of foliage is unduly encouraged and a short crop results. Ashes are a very good manure for tannias.

When the ground is prepared the tannias are lined off at distances of 4 feet by 4 feet in good and fair soil, in a poorer one 3 feet by 3 feet. Planting should be started at the end of the dry season or during any dry spell even in the wet season. The tannia heads may be used as plants or the stem part which grows above ground and is popularly known as the "Maman" tannia may be cut up into sections of a few inches and used as plants. Care should be taken to plant the "skin" part downwards—the cut surface uppermost—placing the cutting in a gently, sloping position, especially in a wet season, is advantageous as it prevents rotting.

Keep the tannia field free of weeds and earth up at each weeding. The earthing up should be done at repeated intervals. The full amount of earthing up if done all at once tends to develop elongated tannias of little value. After six months a first portion of the crop of each plant may be reaped; in no case should the plant be uprooted. In reaping the soil around the plant is removed in disconnected sections and the tannias in those sections, that are sufficiently mature, are pinched off. The plant is again earthed-up and some mulch, if procurable, put around the plant. This periodic reaping can be done at intervals of three months for eighteen months. When treated in this way all the roots are not destroyed and the set back to growth is just sufficient to discourage luxuriance of foliage and to encourage the development of the vegetable or tannia.

DASHEENS.

The Dasheen unlike the ordinary tannia prefers a wet soil and will not do well on a dry loose one. On the stiff clays of the vega lands one dasheen plant will yield up to 20 lb. of foodstuff.

Running water will not do it harm but stagnant water must be drained off.

A trench or hole 6 to 8 inches deep and one foot wide is prepared to receive the plant, the bottom soil of the hole is broken up and the plant placed in it: a little loose mould is then thrown into the hole to secure the plant. In time the hole fills up from washings brought to it by rains and the plant thrives well and develops a large tuft. It is from the centre of the tuft that the largest dasheen is obtained—around this central one many smaller ones develop. When the crop is fit to be reaped the centre dasheen is removed carefully and the hole left by it in the centre of the tuft is plugged up with loose mould, the side dasheens then develop and can be reaped as required.

EDDOES.

Eddoes are not as fastidious, with regard to quality of land, as are the tannia and dasheen. Properly cultivated they do well on any soil. The method of cultivation is similar to that for tannia—being smaller plants they may be planted closer.

The "Chinese" eddoe is a hardier variety than the "Barbados" type which prefers a soil with a large proportion of lime.

CASSAVA.

The Cassava is a valuable food plant and can be used in a variety of ways, either as a boiled vegetable or prepared in the form of cassava meal or farine and tapioca (1). It is also largely used in the making of starch, and from the bitter cassava the valuable juice known as casareep (the basis of many sauces) is extracted. Cassava is grown largely as a catch crop on land which is being newly planted with permanent crops, but it also pays to devote land entirely to its cultivation. To get good tubers the

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(1.) For notes on Cassava products *See* p. 76.

ground must be deeply worked with the fork or plough. Pieces of the mature woody stems about six inches in length taken from the middle portion of the stem are planted in a slanting direction covering them to two-thirds of their length in the wet season, and their whole length in dry weather. Plant at a distance of 4 feet by 4. The crop will be fit for gathering in from eight to twelve months, but can remain in the soil for some time after without injury. On being taken from the soil they must be made use of as soon as possible as the tubers become useless in a few days.

BEANS.

These make a good rotation crop; many of them form valuable foods, and can be readily grown. The *Stizolobium* or *velvet bean* is a very rank grower and is useful for planting on a piece of waste land to smother grass or other weeds. Afterwards dig it in preparatory to planting other vegetables, thereby enriching the soil both in vegetable matter (humus) and nitrogen. What is known in Trinidad as the Overlook or *Sword bean* (*Canavalia ensiformis*), a dwarf grower, is also useful as a rotation or as a cover crop. The young pods make good eating when boiled, and the beans when ripe can be used in soups, etc. Sow the seed singly about 3 feet apart. (*See* also p. 65.)

The *Wax pod* or *Butter bean*, of which there are both dwarf and climbing varieties, is one of the best beans to grow for table use. *Dwarf French* or *Kidney beans* also succeed well, and there are many other kinds such as Lima beans which thrive remarkably well. These all succeed best on a deeply dug, well drained soil, and will respond readily to manure; wood ashes lime and crushed bones suiting them admirably. For climbing varieties sow the seed in drills 2½ feet apart (*i.e.* two drills to a bed) and about 2 inches deep, placing the seeds about 6 inches apart in the drills. As soon as they begin to grow place a row of stakes four or five feet high on either side for them to climb on.

For dwarf, kidney, or bush beans plant the seeds singly in the beds 6 inches apart each way. Earth the plants up when they are about 8 inches high by pulling the soil around the stems. As noted above dwarf beans may be grown on yam and potato banks.

PIGEON PEAS.

These should be more largely cultivated, and the dry peas used as a substitute for the Indian Dhol which is imported in such large quantities. In this form they are valuable for soups, boiling with rice, etc. They may also be used when young as green peas. Sow the seeds during the wet season in groups four feet apart thinning the seedlings to one plant to each hole.

CABBAGE.

Good heads of cabbages can be obtained from deeply dug, heavily manured soil if the seed be sown at the right time of the year. The first sowing should be made at the end of November, afterwards sowing a batch every month until March to keep up a succession during the dry season. They will mature on rich soil in three months. Procure fresh seed of a flat headed variety such as Sutton's "Maincrop," Landreth's "Surehead," or Landreth's "Bloomsdale" all of which thrive well under tropical conditions. Sow in shallow, well drained boxes or in beds of finely prepare soil in the open ground. Sow the seeds thinly, lightly cover with fine soil and keep well watered. As soon as the seedlings are above ground, prick them off into other boxes where they may remain in a position exposed to full sunshine till four or five leaves have formed, when they are ready for planting. If the seeds are sown thinly in beds, they can remain there till large enough to plant into their final position.

When planting place the young plants two feet apart and give a good soaking of water. Cabbages will make a good crop to follow yams as the land will be again vacant by the time it is wanted for that crop.

In the wet season a very inferior cabbage can be grown, but this is useful when the better ones are not obtainable. It is locally known as the Creole cabbage, and is a variety which has been propagated by shoots for a number of years. They never form hard heads, but the young succulent shoots make a good table vegetable. Young plants are raised from shoots taken from old stumps left in the ground from the previous wet season, and treated in the same way as seedlings.

ARTICHOKES.

The boiled tubers of Artichokes are very nutritious and make an excellent substitute for potatoes. They are easily cultivated, and will thrive in the poorest soil, although of course better results are obtained in good, well manured, sandy loam. They like a sunny situation. Select good tubers and plant in rows two feet apart, one foot in the rows, and 3 or 4 inches deep. The best time to plant is in the rainy season at intervals of about six weeks; in this way a supply can be obtained for the greater part of the year. Artichokes are prolific bearers, and a few beds will give quite a large supply. All the attention necessary after planting is to hoe the beds and keep down weeds until the leaves and stems begin to die off when the crop is ready to be gathered.

KOHL RABI.

This vegetable is a member of the same family as the cabbage, the swollen gouty stem being the principal edible portion of the plant although the leafy tops are also eaten. To be of good quality they should be grown quickly and used when quite young, or they will be stringy and possesss a rank flavour. As a substitute for turnips they are excellent the smaller varieties being the best for human consumption.

Sow the seeds as advised for cabbage, and when large enough to handle transplant into well manured beds in rows 15 inches apart, and 9 inches in the rows, keeping the soil between constantly stirred. Kohl Rabi should be fit for the table in about ten weeks from sowing. They do remarkably well in Trinidad and should be more largely grown; at present they are but little known.

BEETROOT.

Sow the seeds thinly in drills one foot apart in beds of well worked soil; afterwards thin the young plants to nine inches apart in the rows. It is best not to manure the beds with fresh stable manure at the time of sowing as this often causes forked roots, but to grow them on soil which has been manured a few months earlier for a previous crop. It is not advisable to transplant beetroot, although this often has to be done because of the ravages of ants which carry away the seeds. When, however, it is necessary take great care not to break the roots, and insert the principal one at full length without doubling it in the hole. Beetroot mature in about twelve weeks.

CARROTS.

Carrots succeed well on a sandy loam, deeply dug to allow the long tap roots to grow straight; in stony or badly worked soil, the roots are apt to fork. Sow the seed in shallow drills one foot apart and lightly cover with soil; thin the seedlings when quite young to a distance of three inches apart.

When large enough for the table pull out every alternate plant, and allow the rest to mature which should take about three months. In dry weather give plentiful supplies of water and keep the beds well hoed.

TOMATOES.

Tomatoes can be grown to perfection in the Colony, and amongst the many varieties tested, the following can be recommended, "Ham Green," "Sunrise," "Champion," "Globe," "Red Rock," and "Ponderosa." Sow the seeds thinly in boxes, or in well prepared beds in the open ground, to obtain sturdy plants, transplant to other boxes or beds when they are about two inches high. The final transplanting should be into beds which have been well trenched and manured. Plant in straight rows three feet apart at a distance of two feet between each plant in the row. Each plant should have a strong four feet stake for support and be tied to it as necessary. All lateral or side growths should be pinched out as fast as they appear, or these will grow at the expense of the fruit. The tomato is a gross feeder and should be liberally supplied with well rotted pen manure when the young fruits have formed. Tomatoes are occasionally subject to various diseases particularly during the wet season, and when badly attacked it is advisable to burn the plants and grow the next crop in a different part of the garden.

LETTUCE.

Cabbage lettuce grow remarkably well and are fit for table at about 8 weeks from sowing. Sow the seed in boxes, in the open, out of reach of ants which are very partial to them: only shade the boxes until the seeds have germinated.

As soon as three or four leaves have formed prick off into other boxes, and afterwards transplant into well manured beds in rows fifteen inches apart and twelve inches in the row. Give occasional soakings of water in dry weather, and keep the surface soil well stirred. Select a few of the best plants, and allow them to grow to furnish seed for the next crop, making sure it is quite ripe before gathering.

EGG PLANTS OR MELONGENES.

Seeds should be saved from good selected fruit, and sown either in beds or boxes; transplant the seedlings when large enough in beds of heavily manured soil at a distance of 3 feet by 5. The flea beetle often proves troublesome, and to check this the plants should be occasionally sprayed with some insecticide, such as nicotine one part in 500 of water, or with lead arsenate. If sprayed with the latter the fruits should be thoroughly washed before being used.

If large fruits are desired, only a small number should be allowed to mature on each plant. In dry weather give a liberal watering and heavily mulch the surface with manure or grass.

RADISHES.

To be of good flavour radishes should be grown quickly, and be fit for use in from twenty to thirty days from the date of sowing. The quicker the growth the more crisp and delicate they will be, and all assistance possible in the way of watering, &c., must be given to help them make rapid growth. Seeds should be sown thinly on well manured beds in shallow drills six inches apart, afterwards thinning the plants to two inches. To keep up a succession of radishes, seeds should be sown every few weeks.

LEEKS.

Sow the seeds thinly in boxes or beds, and as soon as they are large enough, thin to about one inch apart. In a few weeks they will be ready for transplanting, and will succeed best if placed in a light rich soil. There are two methods of planting, but both have the same object in view viz., to get good blanched leaf bases. The trenching method is the one most commonly practised. Trenches about one foot in depth are prepared, the bottom soil being deeply forked and manured. Transplant the seedlings 6 inches apart in the rows at the bottom of the trenches, and as they grow fill the soil in around them. The second method is to make holes from 9 to 10 inches in depth with a large dibber in a bed of well prepared soil. The young leeks are then placed in the holes with just sufficient soil to fasten the roots. As they grow the rest of the hole must be filled in, taking care that the soil does not get between the leaves. The dry season is the best in which to grow leeks; sow at the end of November and they should be fit to gather by May.

CUCUMBERS.

Dig a trench two feet deep and of about the same width; fill with well rotted pen manure, replacing all the soil to form a bank or ridge. Sow the seeds three feet apart on the bank, or a few inches apart in boxes, and transplant when several leaves have formed. Pinch out the tips of the plants when they are about 6 inches high, and afterwards pinch off the tip of each shoot two joints beyond the young fruit to cause them to swell. Place forked stakes or trellis for the vines to climb on. Attacks of green fly or aphis which sometimes prove troublesome can be kept in check by spraying with a solution of nicotine, 1 part in 500 of water.

PUMPKINS AND SQUASHES.

These require much the same treatment as advised for cucumbers except that they must be planted at a greater distance apart, and the vines can be allowed to trail on the ground.

OCHROES.

Sow the seeds thinly in a well prepared seed bed, and transplant the seedlings when about three inches high to rich, deeply dug beds. Plant two feet apart each way. Gather the fruits while young and tender, when they are excellent boiled as a green vegetable or in soups.

SEASONS AND CROPPING PERIODS OF VEGETABLES.

PROVISIONAL RETURN SHOWING SEASON TO PLANT; INTERVALS OF TIME BETWEEN SEED SOWING, TRANSPLANTING, AND REAPING, LENGTH OF CROP AND TIME THE GROUND IS OCCUPIED BY EACH CROP.

Vegetable.	Best Planting Season.	Intervals of time from			Total period ground occupied.
		Sowing to transplant.	Transplant to reaping.	Duration of crop.	
		Weeks.	Weeks.	Weeks.	Weeks.
Tomato	November to May	4	10	8	18
Cabbage	Do.	4	10	8	18
Lettuce	Throughout the year, best time Nov. to January, and May to June	4	4	3	7
Turnips	November to February	3	8	4	12
Artichokes	Throughout the year	...	18	4	22
Beet root	November to January, possibly April to June	4	7	5	12
Carrots	November to June	4	10	6	16
Kohl rabi	November to February	3	6	7	13
Salad Beans	Throughout the year, best time November to March	...	6	2	8
Lima Beans.	June to December	...	10	10	20
Cucumber	December to February	...	6	4	10

L. A. BRUNTON,
Asst. Supt. of Experiments.

THE SWORD BEAN: CANAVALIA ENSIFORMIS.

A Cover and Food Crop.

The Sword or Jack Bean (*Canavalia ensiformis*) has during the last two years made very considerable progress in favour as a cover crop. Although long known in the Colony it has not been seriously regarded until recently when attention was directed to it at the Board of Agriculture by the Hon. Sir Norman Lamont, Bart. who had found it of value in young cacao cultivation, the bean growing under shade better than any other cover crops which he had tried. It has since been taken up on a considerable scale *e.g.* at St. Clair and St. Augustine Experiment Stations, at Friendship Estate, Tobago where Messrs. T. E. Miller and J. Phillips have several acres of it and are using it in young coconut cultivation, and at Roxburgh where Mr. R. B. Archibald employs it in young cacao cultivation. In other parts of the West Indies the plant is also used. For example in

Porto Rico it is stated (*Cover Crops for Porto Rico*, Bulletin 19, 1916) to be "more extensively grown than all other cover crops combined. It has been tested in practically all soils where citrus fruits are grown, and proves to be well suited to a wide range of soil types. It makes the heaviest growth on a well aerated clay loam, but excellent crops have been grown on heavy clays and a growth superior to most crops obtained on fertile sands."

The plant is of a low bushy habit growing 2 to 4 feet high and thus is not objectionable amongst young trees as are the strong climbing, velvet and other beans. It has large leaves and makes fairly heavy growth so smothering weeds, and, if grown for green manuring, yielding a large supply of vegetable matter.

The Sword Bean has moreover a great advantage over most cover crops in that it is edible. The beans can be eaten as ordinary French beans when quite young, and the half ripe and fully ripe beans are good in soups, etc. There is a widely spread popular belief that the bean is poisonous. The experience of Sir N. Lamont, Mr. W. S. E. Barnardo, myself and others, lasting over a year, eating the beans at various stages of maturity, shows that this belief is erroneous. The practical test is corroborated by the chemical analysis appended which shows that the bean is slightly superior in feeding value to the Horse or Field Bean (*Vicia Faba*) so largely grown for stock in the United Kingdom and elsewhere and that it has no trace of any poisonous constituent.

The bean is recommended for cultivation in gardens as a vegetable and on estates as a cover crop. It should apparently also prove valuable as a cattle food, ground up with paddy, corn on the cob, etc. and thus help to reduce the Colony's heavy expenditure on imported foods. In Porto Rico the yield of dry beans per acre is given as 2½ tons.

In planting this Canavalia it should be sown in rows, about 3 feet apart and 1 foot in the row. As a cover crop it can be sown more thickly.

W.G.F.

Analysis.

Synonyms.—Sword, Horse or Jack bean.

Appearance of beans.—White, flattish oval, 6/8 x 4/8 x 2·3/8 in. with brown hilum 3/8 inch.

The whole meal from the beans is a clean and pleasant cream coloured powder. Its taste and odour is pleasant but fainty.

Examination for Toxic Properties.—No evidence was found of the presence of cyanogenetic glucosides.

As small a quantity as ·0004 per cent. of hydrocyanic acid would have been estimated by the method employed.

Nutritive Value.—The table below compares the analysis of the whole meal with that of other beans:

Kind of bean.	Carbo-hydrates.	Proteins.	Water.	Woody fibre.	Ash.	Fat.	Feeding Units.
Sample in question (Canavalia ensiformis) grown at St. Clair Experiment Station, Trinidad... ...	45·2	27·6	15·5	5·4	3·1	3·2	122
Canavalia ensiformis (analysis from Ceylon Manual of Chemical analysis)	55·0	25·0	...	...	...	...	80
Stizolobium pachylobium (grown in Trinidad)	47·2	29·2	11·0	4·1	4·2	4·3	131
Stizolobium aterrimum (Bengal beans grown in Trinidad)	44·3	29 8	12·0	6·2	4 2	3·5	127
Phaseolus vulgaris (French kidney bean)	52·7	23·1	13·6	4·8	3·5	2·3	116
*Phaseolus lunatus (Java or Lima bean)	†67·1	15·9	11·1	...	4·1	1·8	111
Vicia Faba (Field or horse bean)	49·3	23·9	14·5	7·5	3·2	1·6	113
Soja hispida (Soy or Soja bean) ...	30·2	33·2	10·0	4·4	4·7	17·5	157

It will be seen that the sample is a little superior in the figure for feeding units to French, Lima or Java beans. The skins are slightly thicker than those of Kidney beans, and the figure for woody fibre is therefore slightly higher.

The relation between the whole bean and the skin is shown by the following figures:—

Weight of whole bean	Average of 10	1·97 grammes
Weight of skin	Average of 10	·28 grammes
Average percentage of skin		14·4

The proteins of leguminous seeds are mainly globulins and dissimilar to those in cereals and oil seeds (other than leguminous seeds.)

They are more nearly allied to the animal proteins and may possibly be of considerable nutritive value, but although the chemistry of proteins has made great progress of late years, it is still in its infancy and of such complexity that it is still impossible to infer (in absolute terms) a high food value from a high percentage of proteins very roughly approximating in nature to the proteins of animal food. There is no doubt however, that the beans have a similar or perhaps superior nutritive value to those of the French kidney bean.

(Sgd.) HERBERT S. SHREWSBURY, F.I.C., F.C.S.
Acting Government Analyst.

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* Java beans contain a cyanogenetic glucoside and their inclusion in the table is not intended to indicate their desirability as a food.

† Includes woody fibre.

BLACK EYE PEAS.

During recent years the cultivation in the Colony of Black Eye peas has increased rapidly, especially in the Oropuche Lagoon district where a large crop was reaped early this year. In the Southern United States cow-peas, of which the "black eye" is a variety, are highly appreciated and very largely grown. Sown with Sorghum or Guinea corn, they provide excellent hay. Owing to the low expense entailed, land planted in cow-peas is used for pasturing pigs on with very good results. Also, due as in the case of other legumes to their capacity of adding nitrogen to the soil in which they are grown, they are profitably used in the States in rotation with cotton, wheat, oats and corn, *e.g.* 1st year cotton, 2nd year corn and cow-peas, 3rd year winter oats or wheat followed by cow-peas as a catch crop; then cotton again. In Trinidad they are also grown as a rotation crop. The usual practice in the rice lands at Oropuche lagoon being as follows: January sow black eye peas and reap about April, then a second crop of black eye peas or corn depending on the weather, corn being planted if there are early rains; June to November rice and then black eye peas again.

In the United States whilst other varieties are regarded as the most valuable for field purposes, the black eye is the best for table use and it is in this connection that it is chiefly of interest in this colony at the present time.

As yet the black eye pea is not used here as much as it should be with the result that even in a time of scarcity such as now large quantities have been exported, the justification for this being that the supply is in excess of local demand and that as the black eye does not keep for more than perhaps three months, the crop would be wasted if not exported.

The Colony however, imports very large quantities of beans and peas, *e.g.*, (*see* p. 53.)

The black eye pea is of very similar chemical composition to other peas and beans. Each pound of the dry peas contains approximately 3 oz. of nitrogenous material (albuminoids) the essential constituents of meat, and 8 oz. of starch. In the lablab bean the proportions are the same, whilst in the dry pigeon pea or dhall, they are respectively 3 oz. and 9 oz. There is thus little to choose between them so far as the chemical composition is concerned. Black eye peas have been thoroughly proved to be palatable and perfectly wholesome. They are largely eaten in the districts where grown, either boiled alone or with rice. Other people use them for making "bean" soup, also boiled as a vegetable cold and with suitable dressing, as a salad. In all cases it is advisable to put them to soak over night before cooking.

Another way in which they should be more largely used is as a stock feed. In addition to oats on which we spend some £37,000 in 1915 and are spending more now owing to the rise in price, the colony paid for imported cattle foods £31,000 in the same year. The greater use of the locally grown black eye peas would allow these expenditures being reduced. Black eye peas have been employed in this way for some time at the Government Farm and on one or two estates, notably at Esperanza, being ground up with rice, corn, oats, etc. In the States they are also used as a poultry food. It will readily be seen that there is no lack of uses to which black eye peas can be profitably put. There remains finally the question of cost. Black eye peas when in season can be obtained at Oropuche at from $2.00 to $3.00 per 100 lb., and in Port-of-Spain at slightly higher rates. Yet many households use red beans and other imported beans or peas which in Port-of-Spain sell at from $12.00 to $16.00 per 100 lb. That is to say many people pay three or four times as much for an imported bean when a similar article, equally wholesome and nutritious, produced locally and obtainable at about a quarter of the cost has to be exported because there is not sufficient demand for it in the colony. This is a regrettable state of affairs which should cease with fuller knowledge of the value of black eye peas.

W. G. F.

REPORT ON THE PREPARATION AND USES OF MEALS, PARTICULARLY AS FLOUR SUBSTITUTES. (1)

By W. G. Freeman, B.Sc.,
Acting Director of Agriculture.

In view of the large increase in the cost of wheaten flour, and of the possibility of the imports being restricted in quantity it appeared necessary to make experiments to determine whether, meals suitable for bread making could be prepared from locally grown products such as bananas and the chief vegetable root crops.

A set of meals and flours prepared from a large number of these plants, by Mr. H. Meaden, Officer in charge and Mr. J. Blackman, Foreman of the Tobago Botanic Station were shown at the Agricultural Exhibition, Port-of-Spain in March this year, and attracted considerable attention.

Further information has since been obtained in particular as to the yield of meal from the various products, the cost of preparation, and the suitability of the meals for use mixed with wheaten flour in bread making. This work, Mr. R. O. Williams, Curator, Trinidad, has most zealously prosecuted, largely in his own time, and his results are contained in the attached report. (*See* p. 72.)

The following is a summary of the chief points of interest:

PREPARATION.

The products which yield useful meals are:—Unripe bananas and plantains; all varieties including the red banana or red fig which is not generally used here for human food. Tannias, Dasheens, Sweet potatoes, Yams and Bread-fruit.

The yield of meal ranges from 20 per cent. (breadfruit) to about 33 per cent. (dasheen) of the weight of the raw product. All the meals can readily be prepared by simple methods, and without the use of any expensive machinery, so that their preparation is easily practicable in any household. The cost of preparation of the meals (labour only) is about one and a half cents to two and a half cents per lb. These figures are for making the meals on a small scale.

USES.

(1.) *For Bread making*:—Bread making tests carried out in Mr. William's house and my own show that all the meals, excepting the breadfruit, make a very palatable bread mixed with equal parts of wheaten flour, and a quite palatable but rather heavier bread when two parts of the meals are used to one of flour. The bread can be made either with yeast or baking powder.

An indication of the economy which can be effected in a household by making and using these meals as a flour adjunct is given by the following experimental result: A set of loaves was made using in the preparation of each four ounces of wheaten flour which at current price costs two cents. With this was mixed four ounces of one of the meals. The weights of the loaves shortly after they were baked were: Tannia 12 oz., Banana 12 oz., Dasheen 14 oz., Sweet potatoes 14 oz., Breadfruit 14 oz., Cassava Farine

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(1) A report submitted to His Excellency the Governor, July 6, 1917.

12 oz. Wheaten bread at present schedule prices costs two cents for a four ounces loaf.

(2.) *For East Indian Articles of Diet :*—I was very interested to see brought to the East Indian National Congress at Chaguanas, which I was addressing on the Food Supply of the Colony, an extensive exhibit of various forms of roti, dhal puri, etc. These had been made on the initiative of some of the prominent East Indians as a result of attention having been directed by the Department to the use of these meals as flour substitutes. All were composed of equal parts of wheaten flour and banana meal, with for example in dhal puri the usual internal layer of broken dhal or dry peas. They were very favourably commented upon by the meeting. The use of the meals is thus not limited to bread making.

(3.) *Miscellaneous :*—The meals either alone or mixed with wheaten flour make excellent scones; with flour, as in the case of bread, they make good cakes; they also make good porridge, milk puddings, etc. Banana meal biscuits are known in Europe and the meals could thus be used in biscuit making also. There are also many other ways of minor importance in which they can be employed in place of flour in the household.

(4.) *The "Chips" as dried Vegetables* :—In the preparation of the meals there is a preliminary stage in which they are in the form of thin dry slices known as "chips." Dasheen and sweet potato at any rate, can be kept in this form, stored for several months, and recooked as vegetables after soaking the "chips" before cooking in water until soft again.

Mr. A. B. Carr informs me that he has used dasheen in this way for some time. The method is practised in other countries in the case of potatoes, sweet potatoes, etc. and would be a means of preserving tubers such as sweet potatoes and dasheen which are very plentiful at certain seasons but do not keep well. There is of course no necessity to go to this trouble in the case of yams which are pre-eminently a crop for storage.

SUGGESTIONS FOR REDUCING THE LOCAL CONSUMPTION OF WHEATEN FLOUR.

The following are, I am of opinion, the principal points to which public attention should be directed to secure reduction in the cost of living due to the increased price of imported foodstuffs, principally flour, which is a very important question to a large section of the population at the present time.

Every estate and every household should as far as possible grow foodstuffs for its own use. Ground provisions, such as yams, sweet potatoes, tannias, etc. should be employed to provide the starchy constituents of the dietary, the use of bread being reduced to the lowest possible amount.

Supplies of yams and other vegetables which keep well should be stored in their natural state. Surplus supplies of dasheen, and sweet potato should be converted into "chips" and stored in this form, and used out of season as vegetables or converted into meal.

For the bread absolutely necessary, and for which flour is an important and also for other foods largely used locally in East Indian articles of diet ingredient (such as Johnny cakes, dumplings, etc.) the flour should be mixed with equal quantities of meals.

These meals can be prepared chiefly from surplus supplies of perishable crops, and also unripe bananas, etc. which are at times available in larger amount than can be utilized immediately.

The advantage of preparing meals should be urged principally on cultivators who have available the necessary products. The question whether they can be prepared so as to be put on the market on a large scale at a price much below that of wheaten flour is difficult to answer. It would necessitate drying apparatus and other machinery. Putting the price of sweet potatoes at only one cent per lb. and allowing that they yield 25 per cent. of their weight as meal, one lb. of meal will cost 4 cents for materials alone, to this has to be added cost of preparation, distribution, and the profits of manufacturer and retailer. The cost would thus evidently approach closely that of flour in the case of a factory purchasing the raw product in the ordinary way. The case of people growing sweet potatoes, etc. for themselves is very different. The cost is negligible, there are no profits to be allowed for, no machinery is necessary, and the actual labour for making the meal if it has to be paid for will cost only about 2 cents per lb.

I believe, judging from results obtained so far, that useful work can be done by talks and practical demonstration along these lines to District Agricultural Societies and other bodies by Agricultural officers, to small cultivators by the Agricultural Advisers of the Board, and by publication in the *Bulletin* and the press of the information contained in these reports.

The solution of the food question has always seemed to me to depend mainly in getting every one as far as possible to become a producer instead of a consumer only. This is already being achieved to a great extent by the marked increase in provision planting this year; the home preparation of meals will allow part of these provisions being put to a greater variety of uses, and particularly to lessening the consumption of flour, and so reducing the cost of living.

NOTES ON THE PREPARATION OF FLOUR SUBSTITUTES.

By R. O. Williams.

Curator, Royal Botanic Gardens and St. Clair Experiment Station, Trinidad.

Banana Meal.

As a substitute for wheaten flour banana meal is probably one that will be made the greatest use of as it is the cheapest to produce. We have also a number of other starchy foods that can be used, some of which will be described in detail.

Banana meal can be made from any kind of banana or plantain, although it is generally recommended to use those bananas such as the "Red fig" which at the present time are scarcely used at all in Trinidad. On some large estates quantities of this banana can be seen. From a bunch of silk figs the hands were cut off and weighed; they yielded 26·19 per cent. of meal.

When cutting the bananas it is better to cut them before they are quite full than to leave them till they are beginning to ripen, as if too full they will after slicing ripen in the sun, be very difficult to dry and produce a sweet meal. The process of peeling and slicing is a simple one, and can be done most economically by boy labour, the boys becoming quite expert and performing the work quickly and well after a few bunches have been done. Steel knives should not be used on the green fruit as they blacken them unless immersed under water the whole time. A nickel or fruit knife is the best tool to use.

When slicing the bananas the thinner they can be cut the better, as it is essential for them to dry quickly. In the dry season no trouble is experienced, and they will dry thoroughly in a couple of days if spread on wooden trays in the blazing sun. In the rainy season it is a different matter and it is best to choose a fine morning for the work, and if a shower comes on remove them to a dry warm room. A drying room with hot air going through it would be necessary on a large scale, but when doing a few bunches for the home this is not needed as they can always be dried in trays on a warm grate. As soon as the chips are dry they are ready for milling. On a small scale they may be pounded, grated, or better still ground in an ordinary corn mill which can be bought from about $2, upwards. As will be seen from the table appended, after buying the bananas and paying for labour the meal can be produced for about three cents a pound; therefore for those who grow their own bananas and use their own labour the cost is practically nil.

The uses of banana meal are many and varied. It would be as well here to mention that as a food substance banana meal is most valuable, it being very digestible; so much so, in fact, that well-known medical authorities have recommended its use for the feeding of children and invalids; we need therefore have no fear of bad consequences to our health by using banana meal.

Banana bread is best made from a mixture of wheaten flour and banana meal, but in what proportion is a question for the consumer to judge for himself. Personally I use it and find it very wholesome mixed in the proportion of two parts banana meal to one of wheat flour, other people may prefer it half and half, or one-part of banana meal to two of wheat flour. The bread is dark in colour, or lighter according to the amount of wheat flour added, this probably being the only reason why some people prefer the addition of wheat flour in larger proportions. The addition of a certain proportion of wheat flour is necessary to give the bread the proper consistency.

The making of bread can easily be done by the house-wife. Occasionally for some reason a little difficulty is found in getting the banana meal to rise, when the dough is made with yeast, and it has been recommended to set the doughs separately and combine them when kneading. A simpler process I think is to make the bread with baking powder, when it never fails to rise. Take care in mixing, however not to make the flours too wet, as the banana meal is not capable of taking up so much moisture as the wheat flour.

Banana meal cooked and eaten as oatmeal porridge is an excellent food and should entirely replace oatmeal on the breakfast table at the present time.

In cake making the same proportions of banana meal can be used as in the making of bread.

Used in the form of a milk pudding made in the same way as a rice pudding it is also very palatable.

Banana biscuits can also be made from the meal, in fact they have been known in Europe as a fancy biscuit for a long time.

DASHEEN MEAL.

The Dasheen is a moisture loving plant and in some parts of Trinidad it is grown in great abundance, and spare supplies could be utilised in the production of meal. The meal is prepared by peeling the tubers, slicing them thinly and drying in the sun or by warm air. When dry they are ready for milling, and produce a beautiful white meal which makes good bread or cakes used in the same way as banana meal. The dasheen gives a percentage of 34·5 of meal from the tubers. This is the highest yield of any of the articles tried. It can probably be accounted for chiefly because of less waste in peeling owing to their larger size.

Dasheen at the present time are selling in the Port-of-Spain market at the prohibitive price of four cents a pound, which would make the meal work out at 13 cents a pound including labour, thus shutting out all possibility of the dasheen being used if bought from the Port-of-Spain market. In some country districts, however, dasheen can often be obtained very cheaply, and supposing they could be bought for a cent a pound the cost of the meal would work out at about four and a half cents a pound.

SWEET POTATOES.

The planting of sweet potatoes has been making rapid strides during the past few months, inasmuch that some people are beginning to say that there will be a glut in the market when the crop is reaped. Supposing this should be the case Trinidad will be in even a better position because all the spare potatoes can be made into chips or meal. Peeled, sliced, dried and milled in the same way as dasheen they can be made into good bread used with wheaten flour in the proportion of half and half. Of all the breads made from flour substitutes this is my favourite, the bread being light brown in colour of a pleasant slightly sweet flavour and very light. The percentage of flour produced as compared with dasheen is low, it being only 22·72 or roughly four pounds of potatoes make one of meal. This as explained when speaking of dasheen is probably accounted for by difference in size, and thus the proportionate difference in waste. At the time the experiment was conducted potatoes had to be bought at four cents a pound making the meal work out at 19 cents a pound including labour; this of course is not a fair figure as the meal would be made when prices are low. If we take potatoes at one cent a pound the cost of meal would work out at about only 6 cents per pound.

Sweet potatoes cannot be stored for any length of time after reaping as can yams, but they can be peeled, sliced, dried into chips and stored. The dried chips when soaked and boiled in the ordinary way make a good vegetable very little inferior to the fresh product.

TANNIA.

The Tannia as one would imagine makes a meal very similar in appearance and flavour to the dasheen, but does not yield such a heavy percentage of meal, the tannia working out at 27·5, and when bought at four cents a pound making the cost per pound of flour about 16 cents. Here again the tannias were bought at a high retail price, being procurable in the country districts and at other seasons at a much lower figure. Tannia meal makes a good bread used with an equal proportion of wheaten flour.

BREADFRUIT.

Meal is made from this in the same way as the other articles, viz. by peeling, slicing, drying and milling, and produces a very white meal of pleasing appearance. When used with half wheat flour it does not however rise so well as the other meals, and it has a somewhat peculiar flavour to which most people object. From the breadfruit experimented with, which were rather young, 20 per cent. of meal was obtained, and if we reckon to buy breadfruit at 2 cents each the flour would cost eight and a half cents per pound. Breadfruit to dry properly must not be too near ripe or they will ripen after peeling instead of drying.

YAMS.

Yams are converted into meal in the same way as advised for tannia and dasheen. Mr. Meaden of Tobago reports that they make a good white meal and excellent bread. About 25 per cent. of meal is obtained from the tubers.

As a substitute for wheaten flour however, yams are not to be recommended unless available in large quantities which would not otherwise be used, when we have so many other substitutes at hand. The yam is a good starch food in itself with good keeping qualities, so that a supply can be maintained for about the whole year.

	Weight of materials used.	Weight of meal obtained.	Percentage of meal obtained.	Total cost of labour.	Cost of labour per lb. of meal.
Dasheen	21 lb.	7¼ lb.	34·5	10 c.	1·4 c.
Potatoes	22 lb.	5 lb.	22·7	10 c.	2· c.
Banana	63 lb.	16½ lb.	26·2	20 c.	1·2 c.
Tannia	20 lb.	5½ lb.	27·5	10 c.	1·8 c.
Breadfruit	10 lb.	2 lb.	20·0	5 c.	2·5 c.

MEALS, ETC., FROM LOCAL VEGETABLES.

Their Preparation and Uses.

By H. Meaden,
Officer in Charge Botanic Station, Tobago.

Cassava Products.

Farine is made by grating or rasping the peeled tubers, pressing or squeezing the mass through a press or strong cloth to extract the juice, and is then placed in a heated iron-pot or on a piece of an old sugar copper, which should first be rubbed with a piece of "fat pork" to prevent the cassava sticking or burning. The material must be constantly stirred with a wooden rake whilst being dried, when it should be of a uniform creamy colour and will keep for a long time stored in a dry place.

Farine in its crude form is frequently seen on tables and is used as a vegetable with gravy, or it is mixed with tepid water a quarter of an hour before required and also used as a vegetable, or mixed with water and baked into cakes (native method.)

Soaked in milk it can be made into a pudding with eggs and sugar, when it is practically undistinguishable from tapioca.

Dry farine crushed up with ripe avocado pears is very much relished as a dish.

Farine can be used in the place of flour for fish cakes, meat cutlets, croquettes, etc., and boiled in milk it makes an excellent porridge.

Cassava biscuits are made by grating cassava, squeezing out the juice, then sifting through a fine seive, the finely sifted cassava is thinly spread in rings or moulds on a hot iron sheet or girder, the heat sets the cassava immediately, when it is formed into a biscuit, the biscuits should be turned from side to side until thoroughly dried without scorching or burning. A biscuit can be turned out of the ring as soon as it is set and the ring filled again and again; thus several biscuits can be made in a short time; these biscuits are an excellent substitute for bread and will keep well if properly made and stored in a dry place. Cassava biscuits are known locally as cassava bread.

Toasted they are a good substitute for ordinary toast; they can take the place of bread for early breakfast and tea, and should be buttered when hot.

Tapioca is made by allowing the juice expressed in making farine to settle in tubs; the liquor poured off, the fecula heated in a hot pot by which it becomes partially cooked and agglomerated in small, hard irregular lumps. Tapioca is principally used for puddings, soups and invalid's food.

Casareep is also made from the juice expressed in making farine, which is simply boiled down until it resembles molasses in consistency and colour. Casareep is an excellent preservative for meat, is the foundation of many well known sauces and the basis of the famous "Pepper Pot."

An excellent paste is made by boiling the casareep down until it is almost solid; then add red pepper, allspice, cloves, bruised chives, butter, fat pork and a little sugar, or salt, whichever is preferred. The concoction is thoroughly stirred with a wooden spoon and when thoroughly cooked is passed through a sieve and allowed to cool when it sets into a thick paste and can be spread on bread, it is generally used for flavouring soups, gravies, etc., and keeps for a long time.

Cassava farine, biscuits or bread, tapioca and casareep can all be made from one lot of cassava, one after the other.

Cassava Chips.—Peel the skins off the tubers with a bamboo knife (which is easily made by stripping a bit of bamboo leaving both edges sharp and shaping one end into a handle, like a paper knife) or silver or nickel knife (a steel knife is unsuitable as it tends to blacken the cassava) wash well and slice in long thin strips, put the strips out in the sun to dry on wooden trays or matting for 4 or 5 days when the chips are fit to store or to be made into meal or flour by grinding or milling, it is then carefully sifted through fine muslin.

The chips can be soaked at any time and steamed as a vegetable.

The flour will take the place of wheat flour in every shape or form, but the bread made solely from cassava flour is rather heavy.

Cassava Starch is made by peeling the tubers, grating or rasping them and then putting the grated cassava into strong cloths and washing out the starch with clean water: allow to settle, pour off the water and spread the starch in trays to dry. The refuse cassava is used for feeding stock The starch is used by the natives for making "Starch cakes" with sugar and water.

Arrowroot,—The starch is made locally in very small quantities, by washing the tubers thoroughly and pounding in a mortar; the pounded arrowroot is placed in stout cloths with water and rubbed through. The water is then set aside in tubs and the starch allowed to settle; it is washed again two or three times and allowed to re-settle and finally dried on cloths or trays.

The pulp after the extraction of the starch is spread out in trays in the sun to dry from 3 to 5 days; when thoroughly dry it is pounded in a mortar, sifted through fine muslin, when a fine light brown flour is obtained which can be used for making cakes, biscuits, and thickening soups, gravies, etc.

The fibrous material left is used for stuffing pillows and mattresses, in fact if thoroughly dry, it makes as good a stuffing for general purposes as coconut fibre and is not so hard.

BREADFRUIT.

To prepare dried chips and meal the breadfruit is peeled, cut into thin slices and sun dried for 4 or 5 days. The dried chips store fairly well a can be soaked and steamed as a vegetable. The meal is made by milling the dried chips and sifting through fine muslin.

The meal can be used much in the same way as wheat flour, but has a peculiar taste and is disliked by many for that reason.

YAM, TANNIA, DASHEEN AND SWEET POTATO.

Chips and meal are made simply by peeling the tubers, washing, slicing thinly with bamboo knives, set out in wooden trays in the sun to dry for 4 or 5 days—and then milled and sifted.

The three first make the best meal, which can be used for bread, cakes, fish and meat dishes, soups, gravies, puddings, etc. The sweet potato meal is more difficult to make inasmuch as it dries very hard and takes twice the amount of pounding and crushing. Unlike the above meals it imparts a sweetish taste to bread, etc. It can be used in the same manner.

PLANTAIN MEAL.

Plantain meal is made in the same way as the others, *i.e.* peel, wash, slice, leaving out the core, and dry rapidly if possible and sift through muslin. It makes a splendid food for invalids and children, is decidedly superior in these respects to arrowroot in consequence of its nourishing and strengthening qualities, and the ease with which it is digested. It is of a rich creamy colour and has a fragrant odour.

Plantain meal will make cakes, fries, and can be used very much in the same way as the other meals.

MOKO BANANA.

The Moko makes the best banana meal, nearly white in colour. All the other bananas will make meal but of a brown colour, some with a pronounced astringent taste. These meals can be used in the same way as the others.

INTERIM REPORT OF THE FLOUR SUBSTITUTES COMMITTEE, BRITISH GUIANA.

THE Committee appointed by His Excellency the Officer Administering the Government to enquire into and report upon the feasibility of local manufacture from the vegetable products of the Colony of suitable substitutes for or adjuncts to wheat flour and other imported cereal foodstuffs in commercial quantities for consumption in the Colony and for export, to give special attention to the possibility of largely increasing the local output of the raw materials and of the financial aspects of the manufacture and marketing of the resultant products has the honour to forward to you the following interim report for submission to His Excellency.

2. The Committee has held five meetings since the 18th January last and has invited the attendance of various persons whom it believed would be able to give information of value to it in conducting its enquiries. It has taken statements which will be embodied in a final report from the following persons:—

H. Thompson King, Esq., late Commissioner of the North-West District now Stipendiary Magistrate, Essequibo; Americo Santos, Esq., Consul for Brazil; James Rodway, Esq., Curator, British Guiana Museum; H. Gaskin, Esq., Merchant, Georgetown; Charles Shankland, Esq., formerly Inspector of Districts; H. L. Rolleston, Esq., Manager, Colonial Steamer Service; J. Wood Davis, Esq., Merchant, Georgetown; W. G. Harry, Esq., Vice-Consul for the United States of America; Rev. W. G. White, Chaplain, His Majesty's Penal Settlement; J. Correia, Esq., Farmer, No. 2 Canal, West Bank, Demerara River; M. L. Pestana, Esq., Manager, King George Hotel, Georgetown; and J. J. da Silva, Esq., Farmer, Hope and Charity, Pomeroon River.

3. The Committee has conducted investigations in the following directions:—

i.—(*a.*) The feasibility of procuring a locally grown product as a substitute in the total absence of wheat flour, or

(*b.*) as an adjunct to wheat flour in the event of the importation of wheat flour into the Colony being restricted, or

(*c.*) as a substitute to wheat flour in the event of the price of wheat flour continuing to be higher than $8.00 per 196 lb.

ii. The necessity for obtaining a substitute or adjunct of a food value as nearly as possible equivalent to that of wheat in order that the substitution of a locally grown product for wheat flour may not result in the lowering of the food value of bread as a staple article of diet.

iii. The desirability of encouraging the cultivation of vegetable products for the above-named purposes, the possibility of largely increasing the local output of the raw materials and the financial aspects of the manufacture, marketing and export of the resultant products.

4. The Committee has prepared or collated 380 analyses of different varieties of vegetable products of Tropical origin and many others of temperate origin for the purpose of ascertaining their respective food values. These analyses show that the products of Tropical origin which most nearly approach wheat flour in food value are rice, guinea corn and maize. In the total absence of wheat flour it is not feasible to make bread from either of these three products alone. They can be employed alone only in the preparation of cakes. Other products of relatively higher starch content which are of local origin *e.g.* Cassava, sweet potatoes, tannias and eddoes can also be employed in this way but they yield an article of lower food value and nutrient ratio. It is however possible by the addition of a proportion of meal obtainable from locally grown pulses, *e.g.*, pigeon peas, black eye peas, lima and bonavist beans, to bring the nutrient ratio of these more starchy products up to the desired standard.

5. Rice, guinea corn and maize in the event of continued and increasing restrictions on the importation of wheat flour can be employed as satisfactory adjuncts to imported flour in the making of bread; whilst cassava, sweet potatoes, tannias, and eddoes can also be used preferably with the addition of the flour from the pulses mentioned above to supplement their deficiency in protein content. As the result of the Committee's investigations bread of excellent appearance and palatability equal to that of bread made from wheat flour alone has been prepared by the addition of the above mentioned products to wheat flour. As it is not possible here to incorporate the above products with wheat flour during the milling of the latter, success in the preparation of bread with the addition of these products depends on the breaking down of their constituents by the use of boiling water before incorporation with the wheat flour, and by the use of a larger proportion of leaven than is employed in the making of bread with wheat flour alone. Trials conducted by Mr. Pestana, Manager of the King George Hotel, Georgetown, have shown that certain products in the raw state, viz.: cassava, tannias and eddoes by boiling and subsequent straining to remove the fibrous matter can be incorporated with wheat flour so as to produce a bread of even better palatability than that prepared by the use of the flours derived from the same products. By the employment of the above mentioned products in the preparation of bread the amount of wheat flour used may be reduced to possibly one-half of that at present imported.

6. The Committee has purchased machines for the preparation of meals from different vegetable products and is now conducting enquiries into the feasibility of supplying meals in fair quantity to Onderneeming School, to the Lunatic Asylum, Berbice, to His Majesty's Penal Settlement to Mr. Pestana, and to others desirous of assisting it in its enquiries for the purpose of ascertaining the relative course of preparation of bread made with the addition of locally grown product, of which the Committee is not at present able to supply any reliable data.

The Committee has been approached by farmers in more than one district of the colony in order to ascertain whether or not a guarantee will be given that if the areas under cultivation in certain vegetable products are increased the Government will either guarantee or pay a remunerative price for the produce obtained therefrom. The Committee under the terms of its appointment is not in a position to give such a guarantee. It is, however, of opinion that little or no satisfactory extension of such perishable crops as maize, guinea corn and cassava is likely to take place in the colony until there is suitable machinery installed in various districts for drying and curing them. In order to establish the profitable cultivation of such food products the Committee recommends that a subsidy of 15,000 dollars be placed at the disposal of a small Committee of Management appointed by the Government, composed of business men assisted by a practical agriculturist to erect and carry on a factory or factories for converting the raw materials into non-perishable and marketable products and placing them on the market. The adoption of this proposal will be of great importance to farmers as it is likely to develop a system of the greatest commercial value in the various districts of the colony which are devoted to the production of food products generally. The Committee is of opinion that the factory should be worked on a profit-sharing basis with the Government as proprietors and the farmers as producers. The working out of the details of the scheme and its execution should be unreservedly entrusted to the suggested Committee of Management, which Committee should also be responsible for the operation of the factories after their installation.

7. There are still many aspects of the enquiry which are engaging the attention of the Committee, such as the preparation of biscuits, crackers and articles of a similar nature by the use alone of meal obtained from locally grown products.

8. Attached is a table showing the average compositions and food values of bread prepared from wheat flour with the various adjuncts dealt with in this report.

9. The Committee desires to express its thanks to the various gentlemen who have assisted it in making its enquiries, prominent among whom is Mr. M. L. Pestana, Manager, King George Hotel, Georgetown.

By direction of the Committee,

C. K. BANCROFT,
Honorary Secretary.

MEAN COMPOSITIONS OF BREADS MADE FROM WHEAT FLOUR ALONE AND FROM WHEAT FLOUR MIXED WITH VARIOUS ADJUNCTS.

BREAD FROM	Moisture.	Protein.	Fat.	Starch, Sugar, etc.	Fibre.	Ash.
Whole Wheat Flour ...	33·2	8·9	·6	56·2	·4	2·7
Wheat and Rice	27·1	8·8	·8	61·9	·2	1·2
Wheat and Maize	29·8	7·4	·5	59·1	·2	3·0
Wheat and Cassava ...	34·1	6·2	1·1	56·2	·5	1·9
Wheat and Eddoes... ..	35·1	7·4	·6	54·0	·5	2·4
Wheat and Tannias ...	36·9	4·7	·6	56·6	·2	1·0
Cassava only	34·1	2·2	·8	60·4	·8	1·7

	NUTRITIVE VALUES AND RATIO.			
	(1.) FOOD UNITS.		(2.) Nutritive ratio.	(3.) Fat ratio.
	As Analysed.	On 33 % Moisture basis.		
Whole Wheat Flour ...	79·9	80·0	6·5	93·7
Wheat and Rice	85·7	78·7	7·3	77·4
Wheat and Maize	78·8	75·2	8·1	118·2
Wheat and Cassava ...	74·5	75·7	9·5	51·1
Wheat and Eddoes... ...	74·0	76·4	7·5	90·0
Wheat and Tannias ...	69·8	74·1	12·4	94·3
Cassava only	67·9	69·0	28·4	75·5

(1.) *Food Units:* The sum of the starch or carbohydrate contents added to two and a half times the sum of the fat and protein content.

(2.) *Nutritive ratio:* The proportion that the sum of the starch or carbohydrate content and two and a half times the fat content bears to the crude protein content taken as unity.

(3.) *Fat ratio:* The proportion that the starch or carbohydrate content bears to the fat content taken as unity.

C. K. BANCROFT.

RECIPES FOR MAKING BREAD WITH FLOUR SUBSTITUTES.

BAKING POWDER BREAD.

Take half a pound of banana or other meal, half a pound of wheaten flour, and half a teaspoonful of salt and one and a half teaspoonful of baking powder. Mix all thoroughly and then add enough *cold* water to make a rather moist but not too wet dough.

Do not knead but put into a well-greased tin and bake *at once* in a moderate oven for about an hour. If the dough is allowed to stand for even a very short time after mixing it will become sodden and heavy.

YEAST BREAD.

Take a small quantity of yeast and about half a teaspoonful of brown sugar and a tablespoonful of wheaten flour. Mix this with warm water to the consistency of thick cream. Allow this mixture to stand in a warm place for two or three hours to form a *sponge*. Make a mixture of half a pound of wheaten flour, half a pound of banana meal and half a teaspoonful of salt; knead this thoroughly into the sponge to make a stiff dough. The kneading is very important. Place the dough in a well greased tin and stand in a warm place for two or three hours to rise again. When the loaf has risen to about two and a half or three times its original size, bake in a moderate oven for about an hour.

COCONUT BUTTER.

PEEL dry coconuts and grate into a bowl. Pour hot water on the grated material in the proportion of about one pint of water for each nut, and allow to stand for about an hour; then strain through coarse muslin squeezing out all the liquid as completely as possible. Put aside in a bowl all night, or for a few hours if made during the day, by which time all the oil will have risen like cream to the top of the water. Skim the oil off and place in a churn or wide mouthed glass jar, and add one teaspoonful of salt for each nut used. Stand the jar on ice, or in an ice chest until thoroughly cold. Then churn, by shaking the bottle or otherwise and the butter will form in about ten minutes. Turn the mass out into a cloth, mould to shape and keep in the ice chest. If ice is not available the butter can still be made early in the morning and keep solid by placing in a metal dish inside a porous pot with a damp cloth over it and set in the breeze.

Some prefer to boil the grated nut after the water is added.

One ordinary nut yields about a quarter of a pound of butter.

Another modification is to add a teaspoonful of good tin butter to the cream before churning. The butter then forms more quickly and has the colour of ordinary butter.

Coconut butter does not keep more than two days and so should be made in small quantities as required.

It is a good substitute for ordinary butter both for table use and for cooking.

COCONUT OIL is made in a similar manner so far as skimming the cream off after standing. Then instead of churning the cream is placed in a pot and *gently* heated until all the water is driven off. When cool, bottle ready for use.

BIRDS.

THE VALUE OF BIRDS TO MAN.

By James Buckland, London, England.

(*Concluded from p. 42*).

HAWKS AND OWLS.

The injury to trees, crops, and grass by insects is not the only evil that threatens man as a sequence to the destruction of birds. Rapacious birds holds a chief place among the forces which appointed to hold in check small rodents, which breed rapidly, and unless kept within bounds are exceedingly destructive. Yet notwithstanding the unanimous testimony of careful students of birds and their food habits, to the effect that almost all hawks and owls are beneficial, a widespread prejudice still exists against them. They are slain as relentlessly as if they were enemies instead of friends of the farmer.

The destructive habits of the small rodents, which are the natural prey of hawks and owls are much the same all the world round. They do an incalculable amount of damage to standing corn, to corn in the stook or when stacked, to grain to root crops when growing or when piled on the ground or stored in pits, to orchard and forest trees, to the roots of clover and other grasses to ground growing fruits, and to gardens, both flower and vegetable. In addition to this list of crimes, certain rodents are active agents in carrying and disseminating germs of plagues and other diseases.

Here in England—though on account of their small size and secretive habits they are often undiscerned by man's dull eyes—they swarm in such numbers in the fields and hedgerows that the damage they do must prove a steady drain on the resources of the farmer.

The number of small rodents eaten by the rapacious birds is almost as remarkable in proportion to their size as in the number of the insects eaten by small insectivorous birds. During the summer of 1890, a pair of barn owls occupied a tower in a building at Washington. After their departure there were found in the regurgitated pellets, with which the floor was strewn, 454 skulls of small rodents.

The young of hawks and owls remain a long time in the nest, and require a great quantity of food. During the period the resources of the parents must be taxed excessively in the effort to satisfy the hunger cravings of their offspring, and it is not to be wondered at if some individuals are forced occasionally to snap up a chicken. But what is the worth of a chicken, or of a young pheasant occasionally taken, compared with the hundreds of thousands of pounds' worth of damage that is wrought in the orchard and fields by rodents that hawks and owls, had they been spared, would have fed upon for the maintenance of their species?

In 1885 the Legislature of Pennsylvania passed an Act, known as the "Scalp Act" which provided a bounty of 50 cents each on hawks and owls killed within the State limits, and a fee of 20 cents to the notary taking the affidavit. As a result of this Act $90,000 was paid in bounties during the year and a half subsequent to the passage of the Act. An irruption of small rodents followed and did damage to the agricultural interests of the State amounting to $3,850, 000. And even these figures, enormous as they are, do not represent the entire loss. Years must elapse before the balance of nature, which was destroyed, can be restored.

In Montana the destruction of hawks and owls was so complete that rodents, freed from the pressure of their natural check, became as one of the plagues in the Book of Exodus. Then the Legislature passed a law offering bounties for the destruction of these four-footed pests. During six months of 1887 such large sums were paid out in bounties for the destruction of small rodents—a work that the hawks and owls had previously done free of charge—that a special session of the Legislature was called to repeal the Act, lest it should bankrupt the State.

In 1907 Nevada went through a very trying experience with mice, while Utah, Wyoming, California, and several States farther east have all had occasion to bitterly rue the day that they shot their hawks and owls.

But the destruction of small rodents is not the only function of rapacious birds is the economy of nature. Several species are voracious insect feeders. Nor is that all. It is well known that when small insectivorous birds increase abnormally in numbers they, too, become a pest. Hawks and owls materially assist those other agencies of nature which act as a check on the undue increase of small birds. If rapacious birds were rigorously protected in this country we should have fewer complaints of the damage done by sparrows.

Birds of prey, if unmolested, not only prevent the over-production of small birds, but they also confer a salutary benefit on each species on which they prey by checking the propagation of weakness or disease by killing off the sickly and most unfit individuals, for these are the most easily seen and the most rapidly captured. This is particularly true of game fowl, and one of the most plausible hypotheses explanatory of the occasional outbreaks of disease among grouse has been the removal of this corrective by ignorant gamekeepers.

Yet it is my belief that nothing but a miracle will ever make these men see the error of their ways.

Some years ago, when lying in the sweet-smelling heather on the mountain side in Scotland, I pleaded for the life of the hawk before one of its executioners. The gamekeeper listened in silence, until my address to the jury, so to speak, was concluded. Then he said, "Ye've a cold i' the heid." I did not see the relevancy of this remark, but I nodded assent. After a pause he added, "Ah, weel; ye canna complain. The cold aye attacks the weakest place first."

THE ECONOMIC VALUE OF THE WHITE HERON.

The destruction of the white heron for its scapular plumes has robbed half the world of a bird which is most useful to man. It never touches grain, but feeds solely near water and over damp ground, the breeding places of numerous batrachians, small crustaceans, pestiferous insects, all of which directly or indirectly affect crops in the neighbourhood. The presence of the white heron in the rice fields, for instance, is distinctly beneficial to the farmer, and rice is one of the most extensively grown crops of India and of China.

In Australia the slaughter of this and other wading birds for their plumage is causing in that country a decline in its fish resources. It is the destruction of these birds which has led to the ever-increasing multitudes of crustaceans which destroy the fish spawn and the young fish hatching out in the Coorong and the lakes of the Murray Mouth.

In his report on Egypt for this year 1912, Lord Kitchener stated that the indiscriminate destruction of bird life had allowed an enormous increase of insect pests, steps for the combating of which were to be taken. Lord Kitchener knew that in spite of the improved methods of fighting insects there was only one step that he could take that would be effective. A Khedivial decree was issued forbidding the catching or killing of, or taking the eggs of, Egypt's insectivorous birds. In issuing this decree, two things were prominent in Lord Kitchener's thoughts—the destruction of the egret for its plume and the fact that in the Valley of the Nile this bird is one of nature's checks on the cotton worm.

White herons consume many flies, as well as the larvæ of insects in water. This fact is well known to those who have watched habits of oxen and buffalo in Asia or Egypt. There the smaller white herons—the paddy birds of India—live with the oxen or the buffalo, and pick the flies or the ticks from their bodies.

The late George Grenfell noted once on the Congo how a dying white heron, which he had shot and put into his canoe, roused itself, even on the approach at death to snap at the tsetse flies which were settling on his boatman's legs.

VALUE OF BIRDS TO LIVE STOCK.

The injury done to domestic animals by biting and parasitic insects is very great. Herds of cattle are often stampeded by these tormenting creatures, which carry disease and death among them. Another great affliction is the warble which is a small tumour produced by the larvæ of the gad fly, on the backs of cattle, and the constant irritation of which causes considerable depreciation in the value of hides besides, a lessened quantity and poorer quality of beef.

Horses, sheep and other farm animals are subject to the attacks of similar parasites and other persecuting insect foes.

If it were not for the services the bird renders, in alighting on animals in search of these parasites, or in catching the flies on the wing, or in eating them in the embryo state, man would be unable to keep his live stock.

More than this, man himself would be unable to inhabit many places on the earth which he now cultivates, or where he carries on other lucrative industries.

SHORE BIRDS AND DISEASES.

Deadly maladies are carried about by the myriads of mosquitoes and flies that abound on the coasts of tropical and sub-tropical countries. Yet the shore birds, which render invaluable services to man by destroying these venomous pests, are thoughtlessly killed by him in countless thousands.

To his honour, be it said, one of the first acts of Mr. Wilson when he became President of the United States was to issue an executive order prohibiting, under heavy penalties for infraction, the destruction of any wild birds in the Canal Zone.

GAME BIRDS AS WEED DESTROYERS.

Unquestionably weeds serve a useful purpose in nature, but that purpose is not the occupation of cultivated lands. Without check they would speedily choke all grain to death.

Constant use of harrows and hoes will do much on farm lands and in gardens to keep down weeds, but as most earth is full of weed seed, which retains its vitality for years, the life of the tiller of the soil is one continuous struggle against these troublesome plants. In this battle the birds are of great assistance, for the number of weed seeds eaten by birds on cultivated lands, must be beyond any assignable quantity.

Game birds generally are the greatest eaters of weed seeds. They are also useful to man in several other ways. Not only do they devour mature locusts, but they scratch up and eat the eggs. They also consume in large quantities termites and other equally pernicious insects. The reckless shooting of game birds is to be deprecated. They are of far more use alive than in swelling the bag of the sportsman.

The quail is perhaps the greatest weed destroyer of all the game birds. It is doubtful, indeed, if the quail is not more useful to man than any other bird. It is very nearly wholly beneficial. During spring and summer it feeds on many of the most destructive of insects, and in autumn and winter it eats an enormous amount of seeds of many harmful weeds.

But perhaps the most valuable service that quail render the people of United States is the greedy way in which— and they stand almost alone among birds in this particular taste—they eat the evil-smelling potato bug, or, as we call it, the Colorado beetle.

In addition to this inestimable service it is partially due to this bird that the cotton boll weevil has not swept over the entire cotton belt of America bringing ruin to thousands of human beings on both sides of the Atlantic.

THE BIRD AS A SCAVENGER.

The fishing population of these islands has declared war on the gulls, and is demanding the withdrawal of certain species from a list of protected birds, on account of the damage they are alleged to do to the fishing industry. People who believe fishermen's tales are apt to be duped and led into repeated errors. The gull is a surface feeder. It may occasionally levy toll on useful fish, but to say that it does any appreciable injury to the fishing business is absurd.

On the other hand, the presence of the gull is essential to man's health. While the bird fulfils many minor useful offices—such as destroying larvæ in land along the seaboard and in eating enemies of fish that are exposed during low tide—its chief function in the economy of nature is that of scavenger of the harbours and of the littoral, just as vultures are the scavengers of the mainland. The wholesale destruction of gulls for their plumage in Yucatan was followed by a great increase of human mortality among the inhabitants of the coast, which mortality was irrefutably due to the loss of the birds that had kept the harbours and bays free from the decaying matter which the sea is constantly casting ashore.

I wonder if these men who wish the gull destroyed ever give a thought to what would happen to their own smelling villages if this bird was not present to eat the refuse they throw about? Or, again, if they ever reflect on that feeling of relief they experience when in thick weather they hear, through the fog, the clamour of these feathered bell buoys, warning them that they are nearing rock or bar?

THE BIRD AS A GUANO PRODUCER.

Now that I am on the subject of pelagic birds, I will speak of their value as guano producers.

Undoubtedly the present enormous trade in fertilisers owes its origin to the bird, for the fertilising properties of the phosphoric acid and nitrogen contained in fish was not recognised until guano—which is the excrement of sea-birds mixed with fish—became a stimulus to intensive agriculture.

The value of guano as a fertiliser was known to the people of Peru in the time of the Incas, though the nineteenth century had dawned before the information was carried to Europe by Humboldt. Under the rule of the monarchs of old Peru the birds were rigorously protected and the guano deposits carefully guarded. Three centuries later these protective measures materialised in a source of revenue to the country. Generation after generation of sea-birds had placed on their breeding grounds deposits of guano which, in 1853, were estimated by the Peruvian authorities to be worth $620,000,000.

It is our pleasure to think of the Incas as barbarians and to look upon their times as dark and rude. In our own enlightened age man kills at one fell swoop over a quarter of a million sea-birds on an island valuable for its guano deposits.

VALUE OF WILD BIRD LIFE AS A FOOD SUPPLY.

Under certain conditions wild bird life is invaluable to man as a food supply. The pioneer must—at any rate, at the commencement of his farming operations—live in great part on the wild products of the earth. In days gone by the forerunner of civilization could confidently rely on his gun to keep his larder constantly stock with edible birds. Now, in many parts of the world, he is confronted with an alarming scarcity of this kind of food. The great straights to which the pioneer of the future will be reduced on account of the present day slaughter of valuable bird is foreshadowed by what is happening to-day in Hudson Bay. Fifty years ago the number of wild duck in North America was beyond computation. But man could not slay this bird fast enough to glut his blood lust. Sportsmen, professional hunters, and agents of the millinery interests smote them by the million. Such blind and wanton butchery could have but one result. Ducks are now so scarce along the West coast of Hudson Bay where there are no moose, caribou are scarce, and the fishing is poor that the people living there, who had always depended on the ducks they could pack away in the autumn, find it difficult to get sufficient food to carry them through the winter.

THE ÆSTHETIC AND SENTIMENTAL VALUE OF BIRDS.

Omitting all mention of various other material benefits which birds confer on man, I will, before concluding, notice briefly their æsthetic and sentimental values.

Bird life is the part of the creation in which nature has done more in the way of bestowing mental benefactions on man than in any other of her works. Unconsciously received, yet born of it, there is a spiritual teaching, an uplifting influence, in the study of birds which tend to make a man act more constantly from principle which tend to give a new and a more wholesome tone to his whole life.

The companionship of birds affords a happiness as pure perhaps, and as permanently exquisite as man in his present state of being can possibly enjoy. Never came purer joy in my life than when, rising at dawn from my couch of fern, I heard the approach of the coming day heralded by a chorus of glad bird voices. Never have I experienced emotion which have so lastingly impressed my mind as when, in the inexpressible mystery of the darkened forest, with the stars drifting over, I listened to the sublime notes of some feathered psalmist, itself in night invisible.

The world itself is but an outline sketch; it is the birds which fill in the details and complete the picture. Towered vapours of the summer firmament hang on the wall of the sky against a setting of immutable blue; the trees are motionless; the glassy waters of the lake too idle to curve and break upon the shore. Nothing speaks of life or action. Suddenly hitherto unseen in leafy tracery a bird rushes out and up into the air, telling the sunshine all its joys. One can almost hear the mechanism start. The world begins to live and move. What artist is there who does not know this? Even when painting either of the two most majestic scenes on earth—the ocean or the Himalayas—he add this stimulating power to his canvas.

To turn from the pallette to the pen, what poet is there who has not been inspired by birds? From the background of my memory a thousand instances of such inspiration come leaping forth. Shelley, Coleridge, and Longfellow, to mention three only of our singers, have been each rendered immortal in virtue of the power exerted in their minds by birds. "To a Skylark," "The Ancient Mariner," and "The Birds of Killingworth" are poems that are imperishable.

The Mexicans felt the poetry when they looked upon the humming birds as emblems of the soul, as the Greeks regarded the butterfly, and held that the spirits of their warriors who had died in the defence of their religion when transformed into these exquisite creatures in a mansion of the sun.

Earth holds no joy to the eye more sweet than the sight of one of these living gems as it flits to and fro with the shrillest vibration of swiftly beating wings, hovers for an instance in the shade of a pendulous blossom, shoots out again into the sunshine, darts away after an insect, wields round and round in sheer exuberance of spirit, returns to sip at the nectared cup, then flashes up again, glittering with all the colours of the prism, into its home in the air.

Was all this beauty to no purpose but for the gratification of a passing fashion? Is man constitutionally unable to realize that in the beauty of these feathered jewels there is a value greater than the value that is entered in a ledger? Children gather flowers of the field, and presently their fleeting fancy sated, toss them aside to wither and die. But the seeds, the roots, remain. The daisy will bloom another year; the cowslip will stain the meadow yellow as of yore; but these blossoms of the air will never bloom again. Once gone, they are gone forever.

CONCLUSION.

Birds unquestionably are one of man's most valuable possessions, yet it is just the possession on which he sets the least value.

Wherever there are birds, whose plumage is suitable for millinery, there will the cruel and rapacious agents of the feather dealers be found engaged in orgies of wasteful destruction. Wherever there are birds that are classed as "game" there hastens the market unto to kill, kill, kill, so long as any saleable thing remains to be killed. Wherever there are species that have been hurried by man to the brink of extinction, there will be the collector also, anxious to obtain the last lingering representatives of a race before his rival gets a chance to do so. Wherever there are birds whose eggs are valuable, there hurries the egg collector to destroy not only the embryonic life, but often the mature life as well by shooting the bird that laid the egg for the purpose of identification. Wherever in the wild places of the earth there are birds which are considered to be " good sport " there saunters that vandal of creation, the hunter of means and leisure, to expend on the most beautiful and the most harmless works of nature his instinctive desire to kill.

It is the nature of infamies, as well as of disease whose progress is not checked, to daily grow worse; and if the present day wasteful and depraved practice of denuding the world of one of its most valuable natural resources is not checked, there will be wrought a mischief, a universal disaster, more awful in its results than words can express.

METEOROLOGY.

RAINFALL RETURN FROM JANUARY TO JUNE, 1917.

STATIONS.	January.	February.	March.	April.	May.	June.	Jan. to June, 1917.	Jan. to June, 1916.
North West District.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
St. Clair—Royal Botanic Gardens ...	1·17	3·06	1·38	·50	4·24	6·30	16·65	21·36
Port-of-Spain—Colonial Hospital ...	·73	1·33	·32	·03	4·28	5·49	12·18	13·15
,, Royal Gaol ...	·68	1·61	·86	·12	4·18	5·69	13·14	17·05
,, Constabulary Head-quarters ...	·64	1·65	·34	·02	3·47	7·94	15·06	15·52
St. Ann's—Reservoir	1·49	3·76	1·94	·36	6·13	7·00	20·68	22·46
Maraval—Reservoir	2·01	2·44	2·14	·31	5·14	5·29	17·33	26·85
,, Constabulary Station ...	2·86	3·20	1·59	·88	5·63	5·36	19·52	26·02
Diego Martin ,, ,, ...	3·75	3·16	2·00	·54	4·12	7·43	21·00	29·67
,, ,, Waterworks ...	2·92	1·59	2·80	·41	3·35	7·22	18·29	28·08
,, ,, River Estate ...	3·01	1·79	2·47	·42	2·54	7·10	17·33	28·11
Fort George Signal Station ...	1·30	1·54	2·20	·37	4·80	3·32	13·53	23·75
North Post ,, ...	2·16	2·23	1·39	·59	1·77	5·75	13·89	25·18
Carenage Constabulary Station ...	1·36	2·97	2·20	·46	6·15	7·55	20·69	26·28
Carrera Island Convict Depôt ...	1·52	1·40	·50	·04	1·20	2·48	7·14	15·85
Chacachacare Light House ...	2·05	2·05	1·14	·62	4·60	4·78	15·24	14·53
Santa Cruz—Maracas District.								
Santa Cruz Constabulary Station ...	3·14	4·26	1·69	·36	4·73	5·98	20·16	22·31
St. Joseph, Government Farm ...	1·77	1·88	·22	·45	5·95	6·15	16·42	20·19
St. Joseph Constabulary Station ...	1·79	1·61	·12	·30	5·57	4·30	13·69	14·22
Tunapuna, St. Augustine Estate ...	1·76	1·25	·07	·23	6·45	3·84	13·60	16·56
Maracas—Government School ...	3·38	2·62	2·54	·22	6·52	5·21	20·49	25·90
,, Ortinola Estate ...	3·13	3·34	1·10	·38	6·04	4·88	18·87	25·92
Caura, Wardour Estate	2·34	2·33	·70	·37	6·71	5·70	18·15	20·51
West Central District.								
Caroni, Frederick Estate	2·68	2·07	·37	·29	3·56	4·08	13·05	20·44
Chaguanas, Constabulary Station ...	2·01	·77	·62	·19	4·24	6·31	14·14	15·07
Chaguanas, Woodford Lodge Estate ...	1·67	·89	·79	·04	3·61	6·03	13·03	15·61
Carapichaima, Waterloo Estate ...	2·20	1·39	·30	·07	2·76	9·24	15·96	17·04
,, Friendship Hall Estate...	2·50	·95	·50	1·00	3·05	...	...	10·81

RAINFALL RETURN FROM JANUARY TO JUNE, 1917.—Continued.

Stations.	January.	February.	March.	April.	May.	June.	Jan. to June, 1917.	Jan. to June, 1916.
West Central District.—Contd.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
Couva, Exchange Estate ...	0·90	0·58	0·18	0·42	2·80	7·20	12·08	11·55
,, Brechin Castle ,, ...	0·99	0·90	0·50	0·09	3·56	7·91	13·95	16·31
,, Perseverance ,, ...	1·31	0·65	0·26	0·27	2·31	8·46	13·26	13·69
,, Camden ,, ...	1·00	0·70	0·32	0·56	2·43	6·04	11·05	13·79
,, Milton ,, ...	1·61	1·68	0·40	0·46	3·78	6·85	14·78	19·45
,, Spring ,, ...	2·21	2·29	1·18	0·33	6·24	6·67	18·92	18·41
,, Esperanza Estate, Savonetta ...	0·89	1·31	0·21	0·10	2·54	8·49	13·54	17·48
,, McBean Cacao Estate ...	1·26	1·09	0·60	0·54	2·79	6·92	13·20	...
Montserrat District.								
Montserrat, Constabulary Station ...	1·68	1·60	0·32	Nil.	4·80	6·91	15·31	19·66
Brasso, La Vega Estate	2·74	2·00	0·58	0·70	6·96	10·68	23·66	25·43
Brasso Piedra, Mamoral Estate ...	3·57	2·15	2·13	0·40	5·87	8·67	22·79	...
,, La Mariana... ...	3·16	2·66	1·00	0·26	6·14	9·67	22·89	...
Arima District.								
Arima, Warden's Office	1·47	0·97	0·12	0·10	5·68	...	...	20·55
Arima, Torrecilla Estate	3·44	2·17	0·57	0·65	7·35	9·51	24·22	25·05
Arima, Verdant Vale Estate ...	2·49	2·24	1·04	0·38	7·03	9·13	21·31	31·76
San Rafael, Constabulary Station ...	4·02	2·45	0·45	0·96	7·76	7·92	24·56	31·83
Guanapo, Talparo Estate	3·92	2·15	1·53	0·68	9·61	6·81	24·70	25·75
Guanapo, San José Estate... ...	4·28	2·30	2·29	0·76	6·97	8·78	25·38	32·95
Tamana, Santa Marta Estate ...	4·72	3·52	1·48	0·77	7·91	12·00	30·40	37·05
,, La Corona Estate... ...	5·19	3·54	1·99	1·14	6·56	11·98	30·40	40·58
San Fernando & Princes Town District.								
Claxton's Bay, Forres Park Estate ...	1·08	1·21	0·23	0·08	3·39	7·08	13·07	16·53
Pointe-à-Pierre, Bonne Aventure Est...	0·93	1·02	1·36	0·11	3·66	6·41	13·49	17·46
,, ,, Concord Estate ..	1·32	1·11	1·35	0·15	3·46	9·13	16·52	19·17
,, ,, Plein Palais Estate ...	1·25	1·42	0·60	0·25	3·21	10·25	16·98	16·18
Naparima, Picton Estate	1·24	0·95	0·72	0·23	4·02	9·64	16·80	18·02
,, Usine Ste. Madeleine Est....	1·32	0·95	0·60	0·21	4·35	6·81	14·24	19·44

RAINFALL RETURN FROM JANUARY TO JUNE, 1917.—CONTINUED.

STATIONS.	January.	February.	March.	April.	May.	June.	January to June, 1917.	January to June, 1916.
San F'do & Princes Town Dist.—Contd.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
Naparima, La Fortunée Estate ...	·90	1·61	·72	·28	4·87	6·37	14·75	17·98
,, Lewisville ...	1·42	1·10	·41	·15	4·14	9·84	17·06	22·73
,, Tarouba Estate... ...	·50	·38	·26	Nil	2·64	6·56	10·34	10·95
,, Union Hall Estate ...	1·09	·92	·93	·17	4·97	7·87	15·95	19·30
,, Palmiste ,, ...	1·38	1·16	1·37	·21	5·96	11·72	21·80	20·02
,, Hermitage ,, ...	1·23	·98	·72	·09	4·90	6·57	14·49	16·42
,, Petit Morne ,, ...	·62	·37	·52	·08	3·40	5·98	10·97	17·07
Princes Town Craignish Estate ...	1·07	·86	1·18	·23	3·38	4·32	11·04	20·56
,, Cedar Hill Estate ...	1·62	·94	·92	Nil	3·98	6·58	14·04	21·43
,, Williamsville Estate ...	1·40	1·26	1·23	Nil	3·97	6·15	14·01	23·99
,, Esmeralda Estate ...	1·36	1·11	1·53	·34	5·17	9·48	18·99	23·44
,, New Grant Estate ...	1·91	2·00	1·63	·44	4·67	6·43	17·08	23·26
,, Constabulary Station ...	·94	·54	1·37	·18	3·18	5·43	11·64	18·31
,, Hindustan Estate ...	1·77	·72	1·51	·34	4·16	5·76	14·26	25·67
,, La Retraite Estate ...	3·33	2·70	2·41	·52	7·69	8·35	25·00	36·70
,, Malgretoute ,, ...	1·65	·94	1·09	·26	3·92	6·72	14·58	21·52
,, Friendship & Ben Lomond Estates	1·79	·85	1·16	·13	3·70	7·69	15·32	19·78
,, Los Naranjos Estate ...	1·37	1·14	·69	·49	4·79	6·87	15·35	...
Poole, El Rosario Estate	3·40	2·17	2·01	·80	7·49	8·36	24·23	34·50
South-West District.								
Oropuche, Constabulary Station ...	1·44	2·83	·89	·38	4·06	7·95	17·55	20·01
,, Pluck Estate	1·18	1·82	·27	·15	2·63	6·07	12·12	22·38
Siparia, Constabulary Station ...	1·85	2·16	1·09	·77	4·46	7·43	17·76	21·85
,, Alta Gracia Estate ...	1·56	2·60	1·45	·40	3·99	7·59	17·59	25·42
Guapo, Adventure Estate ...	1·88	3·53	1·59	1·11	3·18	7·85	19·14	23·37
Cap-de-Ville—Constabulary Station ...	2·38	4·46	1·91	1·49	4·35	8·78	23·37	29·92
Erin, La Ressource Estate... ...	2·95	5·25	·46	Nil	1·39	11·43	21·48	13·83
,, Industry Estate	2·51	5·56	1·41	·66	1·82	9·04	21·00	19·13
,, La Union Estate	2·71	5·94	1·40	·47	1·73	10·29	22·54	...
Cedros, Constabulary Station ...	2·59	5·07	1·99	·03	1·37	9·02	20·07	25·10

RAINFALL RETURN FROM JANUARY TO JUNE, 1917.—CONTINUED.

STATIONS.	January.	February.	March.	April.	May.	June.	Jan. to June, 1917.	Jan. to June, 1916.
South-West District.—(Contd.)	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
Cedros, Perseverance Estate ...	2·78	4·70	0·71	0·52	1·08	9·32	19·11	26·06
,, La Retraite Estate ...	2·92	5·02	3·71	1·23	2·35	9·39	24·62	37·12
,, Beaulieu Estate	2·50	4·37	1·12	0·36	1·64	9·95	19·94	24·66
,, Ste. Marie Estate	3·10	5·75	1·44	0·51	1·37	7·88	20·05	26·85
,, Ste. Quintin Estate ...	2·75	3·77	0·65	0·34	1·26	8·58	17·35	...
Icacos, Constance Estate ...	2·14	1·97	0·71	0·37	1·98	19 23	26·40	29·59
Irois, Government School... ...	2·76	8·66	3·15	1·14	2·42	12 54	30·67	35·12
South Coast.								
Moruga, Constabulary Station ...	1·73	2·59	1·23	0·29	2·37	10·44	18·65	22·62
East Coast.								
Matura, La Juanita Estate... ...	3·26	3·09	1·76	1·40	7·75	10·53	27·84	31·75
Manzanilla, Constabulary Station ...	4·71	4·08	0·72	0·54	6·18	9·67	25·90	30·89
Sangre Grande, New Lands Estate ...	4·17	4·65	1·74	0·81	8·35	10·73	26·28	31·05
,, Evasdale Estate ...	4·89	3·89	1·13	0·84	6·67	8·46	25·88	34·50
,, Grosvenor Estate ...	5·71	4·68	1·35	1·12	6·78	10·69	30·33	34·77
,, San Hilario Estate ...	4·11	1·91	2·13	1·00	6·18	9·26	24·59	28·77
Mayaro, Constabulary Station ...	3·31	1·69	2·43	0·77	5·48	8·86	22·54	25·12
North Coast.								
Blanchisseuse, Constabulary Station ...	5·11	2·32	5·59	0·60	4·23	8·36	26·21	27·94
Grande Rivière, Mon Plaisir Estate ...	7·02	4·36	1·06	1·43	6·16	10·63	26·66	39·68
Toco, Aragua House	4·08	2·60	0·37	0·32	5·11	7·24	19·72	27·84
,, Constabulary Station ...	4·58	2·27	1·24	0·47	4·93	7·65	21·14	23·56
Point Galera, Light House ...	2·41	1·83	0·56	0·60	4·18	6·30	15·88	17·64
Tobago.								
Tobago, Hermitage Estate ...	2·73	2·30	2·50	·52	3·28	11·20	22·53	31·59
,, Riversdale ,, ...	2·74	2·89	1·98	·29	2·74	10·32	20·96	21·40
,, King's Bay ,, ...	4·65	4·79	2·65	·87	3·87	8·84	25·67	27·66
,, Roxburgh ,, ...	4·01	4·60	2·84	·83	3·54	10·73	26·55	35·87
,, Luré Estate ,, ...	3·59	3·43	2·64	·46	2·47	7 82	20·41	30·08
,, Botanic Station	1·49	4·24	·59	·78	3·53	7·12	17·75	22·20
,, Government Farm ...	1·60	2·88	·19	Nil	2·04	4·81	11·52	15·24
,, Lowlands Estate	1·42	3·88	·86	·22	3·54	6·19	16·11	15·83
,, Friendship ,, ...	·44	3·67	·56	·19	2·05	4·48	11·39	17·05
,, Bon Accord ,, ...	1·76	1·90	1·78	Nil	1·81	4·92	12·17	17·30

(*Bulletin, Department Agriculture, Trinidad and Tobago*, pp. 51–94. Issued August 13, 1917).

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Trinidad and Tobago.

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RUBBER.

RUBBER CULTIVATION IN TRINIDAD AND TOBAGO.

Report of the Special Committee of the Board of Agriculture.

THE PRESIDENT OF THE BOARD OF AGRICULTURE,

The Committee appointed by His Excellency the Acting President on April 19, 1916, "to investigate and to report upon the present position and prospects of rubber cultivation in the Colony, and to suggest means whereby the most efficient methods of tapping and an uniform method of preparing rubber may be introduced on each plantation" (33)* has the honour to report to Your Excellency as follows:—

The Committee held meetings on May 17 and 18, June 3, 10, 11, 12, 17 and 22, July 11 and 20, August 12, September 20, November 4 and 9, 1916, and January 17, March 19 and 20, May 26 and 28, June 21 and 22, and July 9, and 19, 1917.

The Committee visited the following rubber plantations: St. Clair and St. Augustine Experiment Stations, Newlands, Los Hermanos, Government Plantation in Central Range Reserve, Plaisance, Bonne Aventure, Concord, Eureka, Palmiste, Cedar Grove, Poole, Craignish, Sta. Anita, Wyaby, Monte Cristo, Industry, Verdant Vale, Non Pareil, San Remo, Evasdale, Ste. Marie, and Haleland Park, and, accompanied usually by the proprietor or manager, made a personal investigation of the rubber cultivation upon them.

In order to supplement the information obtained as above, the Committee prepared a Schedule of Questions (33) and circulated it to the proprietor or manager of every estate in the Colony which possessed (so far as could be ascertained from the Wardens' Returns) any extent of rubber cultivation.

The total number of such estates appears to be at least 155. From 52 of these, replies were received to our interrogatory, containing in some cases much useful information. About 100 rubber proprietors, on the other hand, did not take sufficient interest in our enquiry to vouchsafe any answer.

Apart from our personal visits of enquiry, and from the replies to our Schedule of Questions we have carefully searched the available literature for any matter bearing on the history of rubber cultivation in this Colony, so far as pertinent to our enquiry. (*See* Appendix D.)

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* Numbers in brackets refer to items in the Bibliography, Appendix D. (pp. 136-151).

It appears that in August 1910 a Standing Committee of the Board of Agriculture was appointed to deal with questions affecting the Rubber Industry, just as similar standing Committees still deal with the Sugar and Cacao Industries. This Committee was composed of Mr. John Moodie and Mr. J. H. Wade. Mr. W. G. Freeman was subsequently added. For a time the Committee seems to have been active in the work for which it was appointed. But gradually interest in rubber waned throughout the Colony; Mr. Wade died, and Mr. Moodie resigned his membership of the Board. No one was appointed to fill their places, and for some years little or no active interest was taken by the Board in the Rubber Industry.

The present Committee was appointed in consequence of the motion of our Chairman quoted above which was carried unanimously at the meeting of the Board on April 19, 1916. (33)

General.

Hevea brasiliensis (Para Rubber) and *Castilloa elastica* (Central American Rubber) are the species principally grown in the Colony. It will probably be desired that we should deal with these two very different crops separately, and we accordingly do so in this Report.

The total area under rubber in the Colony is still largely a matter of conjecture. Replies to our enquiries have been, as stated above, by no means universal. The new forms of Wardens' returns provide information but little more enlightening or reliable than the old. For instance, the Warden of Diego Martin returns 1,312 acres under rubber cultivation in 1916 in Diego Martin Ward, and none at all in St. Ann's. Such a return is obviously highly imaginative. But omitting these two Wards altogether it would appear from the Reports of the other Wardens that there are about 1,500 acres of rubber cultivation in the rest of the Colony. Our investigations indicate that there is, besides, a larger area under mixed cultivation of rubber with other crops—generally cacao—but occasionally coffee or limes.

Upon the 52 estates in Trinidad and Tobago making returns to our enquiries, there are 130,593 *Hevea* trees, 81,975 *Castilloa*, and 45,000 *Funtumia*, say 250,000 trees altogether. Figures for the 103 estates which have not favoured the Committee with returns would undoubtedly increase the above totals very largely; especially in regard to *Castilloa*. Great numbers of *Castilloa* trees, moreover, have been in recent years cut down or allowed to die out.

The principal rubber districts are (1) the County of St. Andrew, (2) Tobago, (3) the County of Victoria; these according to the Wardens' Returns contain among them more than 1,200 acres out of the total of 1,534. Almost every district of the Colony shows traces of an attempt to start a rubber industry, sometimes (as at La Brea) on quite a considerable scale. But, whether because the heavy fall in rubber prices made it less attractive, or because of the lack of any attempt to organise the industry here, or from ignorance or impatience, the attempts have not often been continued to the point of success, even where *Hevea* had been planted.

The rubber areas accordingly present but too frequently a derelict appearance. Except in Manzanilla (County of St. Andrew) there is now no evidence of any extension of the cultivation. But considerable capital has been sunk in other parts of the Colony, and one of the most anxious problems before the Committee has been how far it is possible for planters in these less favourable districts to realise any return upon capital invested.

The following table shows the total exports of rubber from Trinidad and Tobago during recent years:—

Exports of Rubber—Trinidad and Tobago.

Year ending.		*Total lb.*	*Value £.*
March 31,	1905	3,659	549
do.	1906	9,394	1,221
do.	1907	27,505	4,150
do.	1908	4,444	603
do.	1909	4,614	617
December 31,	1909	13,234	1,388
do.	1910	7,376	1,395
do.	1911	4,867	730
do.	1912	6,916	1,040
do.	1913	6,454	1,291
do.	1914	4,642	500
do.	1915	5,492	668
do.	1916	10,170	1,524
To Sept. 30,	1917	12,102 (nine months)	

Para Rubber. Hevea brasiliensis.

Hevea brasiliensis Muell., the source of Para rubber, a native of the Amazon Valley, was introduced into the Colony in 1876 when two plants were received by the Botanical Department from the Royal Botanic Gardens, Kew. (34)

The cultivation of *Hevea* into the Colony has been handicapped by the fact that, in the early days, the weight of official opinion was thrown distinctly on the side of Castilloa, as indicated by the following extracts from and references to reports by Mr. J. H. Hart, F.L.S., late Superintendent of the Royal Botanic Gardens:—

In his *Annual Report—Royal Botanic Gardens, 1897*, pp. 14–15, he gave a general review of Rubber in this Colony. (2)

"Several kinds of rubber are grown, the following being a list of the species cultivated:—

1. India Rubber—*Ficus elastica.*
2. Para or Brazilian Rubber—*Hevea braziliensis.*
3. Ceara or Brazilian Rubber—*Manihot Glaziovii.*
4. Demerara Rubber—*Hevea Spruceii* and *H. pauciflora.*
5. African Rubber—*Kickxia africana.*
6. African Rubber—*Tabernæmontana crassa.*
7. West African Rubber—*Landolphia* species.
8. Central American Rubber—*Castilloa elastica.*

"Of these, according to our experience, the most suitable for growth in Trinidad is *Castilloa elastica.* Trees in the Gardens are over 60 feet in height, and from these we have now annual supplies of well ripened seed. Both in 1896 and 1897, the demand for young plants has exceeded our means of supply, but as the trees increase in size, larger supplies of seed will of course come to hand, and we shall be better able to meet demands.

"I hear from several cultivators that trees purchased at the Gardens are growing rapidly and well, which fact is encouraging to those about to commence cultivation.

"*Castilloa* is a tree that—in Trinidad—grows quickly, and if in good land, may be expected to be large enough for bleeding in seven or eight years. The grower, however, must take great care in early bleeding not to exhaust his trees. At the Royal Botanic Gardens trees 8 years of age yield a large quantity of latex or milk and experiments are now being carried on to enable us to say with accuracy what trees of a given age should produce. It has recently been ascertained that the rubber of Castilloa can be readily separated from the latex, by a mechanical process, very cheaply, and producing rubber of the best quality.

"By this process the rubber is separated from the water, albuminoids, proteids, etc. very quickly, and never becomes foul as in the case with rubbers produced by coagulation, and therefore may always be expected to make the best price in the market.

"I am informed by an expert who had recently been in the Ceara rubber district of Brazil, that *Hevea* and *Ceara* latex will not yield up its rubber by the mechanical process. I have mentioned, which is a fact worthy of note in favour of planting *Castilloa*, especially as the difference in price between the best qualities of Para and Central American Rubber is merely nominal. Some of the advantages of planting *Castilloa*, may be here enumerated:—

1st—It takes but few years before obtaining returns.
2nd—It is easily tapped, and the latex is given off in good quantity.
3rd—The rubber can be obtained by mechanical means.
4th—The rubber is of the finest quality.

"It is further estimated that trees will yield, according to size and age, from two to six or eight pounds of rubber per annum, and when this is valued, as it now is, at rates over three shillings per pound, it is not hard to see that a paying industry will result . . . .

"The *Heveas*, or the Brazilian and Demerara rubbers, are trees of large size, and do not bleed so freely as *Castilloa*, neither do they grow so quickly, but they have the advantage of being able to grow in places where *Castilloa* could not thrive. Trees of large size are present in the Garden, and annually give us seed in limited quantities. . . . .

"Latest advices from Europe show that there is a prospect of being able to obtain annual crops of *Castilloa*. It has been found from experiment that small stems of one year's growth contain as much as seven or eight per cent. of their dry weight of good rubber, that amount having been extracted from material grown in Trinidad. If this experiment can be worked out on a large scale, it is not hard to imagine fields of *Castilloa* reaped annually, and large factories for manufacture of the crop. The latex of our rubber trees (*Castilloa*), has been proved by careful experiment to give twenty-five per cent. of its weight, in pure and clear rubber.

"Near the close of the year, His Excellency the Governor informed the Legislative Council, that he wished to initiate the growing of rubber on Crown lands, and I have received instructions to suggest the district and lands where operations of this character could be successfully carried out. My recommendations have been sent in, locating an area of some 300 acres for the purpose, and I expect to receive final instructions in due course. It has been abundantly proved that *Castilloa* rubber can be most successfully grown here, but an initiative is sadly wanted to turn the matter into a commercial success. The planting of a large area like this, by the Government, is not in any way a new departure, for the same thing has been done in India and many of the Colonies, with Cinchona and other things, and Government plantations of rubber are at the present moment being well maintained in Ceylon, with a strong probability of their being still further extended."

In the *Annual Report* of the Royal Botanic Gardens for 1899 page 9, the statement is made that "*Castilloa* promises the best of any of the Rubber, so far, for local cultivation." *See* also in Appendix D. bibliographical references Nos. 1, 3, 5, 7, 65, 67, 71, 73.

In 1902 Dr. (now Sir) Daniel Morris recommended *Castilloa* as "the best rubber tree to cultivate in the West Indies." (78) As recently as 1911 the Tobago Planters Association favoured *Castilloa* on account of the lower demands it made on labour (26).

These opinions were unfortunately formed and promulgated before any conclusive tests, under estate conditions, had been made in order to ascertain the comparative growth and yield of *Castilloa* and *Hevea*. Undue importance was attached to rapid growth in young trees, yielding latex at an early age. An example of this is Mr. Hart's suggestion of treating *Castilloa* as a coppice-crop, to be cut down annually and crushed to extract the rubber, (72) and (77). Both quantity and quality of rubber were inferred from single tappings of isolated trees (79).

In Ceylon and the Straits Settlements on the other hand, Willis and Ridley who also began work on rubber in the Botanic Gardens about 1897, carried out experiments on a definite plan to obtain information as to the yield of trees per annum, as to wound-response, etc., before giving advice to planters.

The consequence of the advice given to planters in Trinidad and Tobago was that the majority planted *Castilloa*, whilst *Hevea*, on the other hand, has been planted, except in a very few instances, only upon an experimental scale, or among cacao, or along the edges of cacao-fields. But for the enthusiasm of Mr. J. B. Carruthers, who succeeded Mr. Hart in the charge of the Botanical Department, the extent of *Hevea* cultivation would probably be still smaller. Coming from the East where *Hevea* was already an assured success, and *Castilloa* was regarded as of no importance, Mr. Carruthers was naturally prepossessed in favour of the former; but seems to have felt that he would not have been justified in condemning *Castilloa* off-hand.

During his short career he was active in the endeavour to build up a rubber industry in this Colony, and with that object in view set about "obtaining accurate and reliable data by exact observation and experiments." "By this means" he continued, in the only paper he published during his short term of office, "the planter who is at present waiting timidly on the bank will be encouraged to plunge, and will also have figures to enable him to choose between the rival merits of *Hevea* and *Castilloa.*" (18).

Mr. Carruthers avoided expressing any definite conclusions in the paper referred to above; he reviewed for the planter the available evidence, and we feel we cannot do better than give his remarks *in extenso.*

"From general observations, however, I am of the opinion that the growth of Para rubber under the local conditions is very little if at all inferior to that of the trees of the same species in Malaya and Ceylon treated in the same way. Of the relative growth of Castilloa I have still less reliable data to form an opinion, but observations in different parts of Trinidad and Tobago lead me to the belief that Castilloa and Hevea (Para) grow equally well and vigorously here. It is true that in places Hevea seems to thrive more than Castilloa, but the reverse can be observed and I do not think there is any reason to suppose that taking the island as a whole either plant grows more vigorously than the other.

HEVEA OR CASTILLOA ?

"The decision for intending rubber planters as to which plant may be expected to prove more profitable is not easily settled. The chief arguments in favour of Hevea are that it grows vigorously on comparatively poor soils which are well drained. That the yields of rubber from trees already tapped, as far as they have gone compare favourably with those of similar age in other countries. That the method of extracting the latex from the Para rubber trees has been brought to a degree of perfection which though still capable of improvement is eminently satisfactory and practical. Against this, however, as previously mentioned is the argument that these methods of extracting the latex from Para involve a large amount of regular daily labour which we cannot hope to reduce by mechanical means.

"That the rubber of cultivated Para trees has secured a high place on the markets of the world as a valuable rubber, and is in continual demand by the manufacturer.

"That the coagulation is easy and the preparation of dry rubber well understood and easy process.

"The arguments against Para as compared with Castilloa are, that the supply of seed locally is limited and importing them from the far East is by no means an easy or certain way of getting plants. That the plant when young is greedily eaten by almost all animals. I have seen many thousands of plants in a large nursery browsed down by a cow; and deer, monkeys, pigs, &c., are very fond of the plant.

"The arguments in favour of planting *Castilloa elastica* are to some extent more based on expectation than on exact data. The tree grows vigorously and in some cases when side by side with Hevea compares favourably with the latter. An almost unlimited supply of seed and young plants is available. The important question of probable yields is not an easy matter to express an opinion on. Large plantations of Castilloa exist in Mexico and other countries but figures of the yields as far as they are obtainable, do not show anything like the return which

Hevea has given in Malaya and Ceylon. The differences in the returns from large areas in Mexico of Castilloa and in Malaya of Para are enormous. In the latter country in one State, Negri Sembilan, 300,000 tapped trees gave an average of 2lb. 7 oz. per annum while the highest Mexican figures on a sizeable area I have seen are ¾lb.

"The results of all observations and experiments which have been carried on in Trinidad and Tobago are most encouraging in regard to the amount and quantity of the latex in the tissues of Castilloa trees of age and size, but the methods of extraction are at present by no means satisfactory.

"I carried on very few experiments or observations in extraction of latex from Castilloa when in the East, the planting of that tree not being considered as against Hevea.

"Since my arrival in the West Indies I have been making many tentative experiments and observations as to tapping Castilloa and am of the opinion that the methods which have been used for extraction of latex up to the present are unsuited to the structure of the tissue of Castilloa and the arrangement of its latex vessels. The use of the knife in Hevea causes little or no gaping of the wound, and the bark tissues can be cut smoothly and very thin. In Castilloa the fibrous character of the tissues make it difficult to cut clean or thin and there is always a widening of the wound which takes a long time to heal and is the potential harbourer of insects, fungi and other undesirables. For these reasons I am inclined to believe that if the latex can be extracted with minimum of wound to the tree, and the same time by a process which can be done quickly, and is therefore labour-saving, a great advance will be made in the method of tapping Castilloa."

Whilst Mr. Carruthers did not apparently feel justified, pending the collection of more accurate data than was available to him, in throwing the weight of his opinion more definitely on the side of *Hevea*, his actions generally indicated to which side he inclined. Definite experimental work was commenced on an estate scale, and through his initiative, the Government in 1909-1910 arranged for the importation of 2,000,000 *Hevea* seeds from Malay.

Results since then have been obtained which demonstrate that *Hevea*, under favourable conditions here, gives a return of rubber per acre comparable with that of average estates in Ceylon and the Federated Malay States. *Castilloa* everywhere has proved a costly disappointment. As both these plants were introduced into the Colony over forty years ago, a proper series of experiments would have brought out these results much earlier, and so have prevented useless expenditure of money and effort. But the early advice was given on inadequate grounds.

HEVEA AS A PURE CROP.

The outstanding examples of *Hevea* grown as a pure crop are in the County of St. Andrew, and include the estates of Non Pareil and Newlands.

At Non Pareil, the property of Mr. E. A. Robinson, there are approximately 60,000 trees. The oldest were planted in 1905.

In field, "Lalla," planted 1907, the trees are planted 14 feet x 14 feet and in 1916 averaged 31 inches in circumference at 3 feet from the ground. These trees were originally planted alternately with cacao, but as they reached maturity, the ground became overcrowded, and the cacao as the less profitable crop, was cut out in 1915, leaving the *Hevea* in sole possession.

The cost of cultivation appears low compared with that in the East. Clean-weeding is not practised; and Lalang (*Imperata koenigii*), white ants (*Termes Gestroi*) and root fungus (*Fomes semitostus*), the three great bugbears of the Eastern planter, do not, (at least as yet) cause trouble or even anxiety here.

Only one instance of injury by white ants was brought to our notice, viz., a field of 2,000 young *Hevea* on freshly cleared land at Santa Marta, Tamana, was destroyed by this pest for two years in succession.

At Newlands the oldest rubber from Ceylon seed, dates from 1907. It was planted at 14 feet by 14 feet alternately with cacao; and although the cacao was removed in 1915, the rubber trees still stand at their original distance. At the time of our first visit in June, 1916, the trees averaged 50 feet in height and 27 inches in girth. When we visited the estate a second time, in July, 1917, the average girth had only increased by one inch, viz., to 28 inches. A considerable reduction in their number per acre will have to be gradually brought about if a more rapid increase in girth is to be secured.

Thin, overshaded trees can neither give a good yield of latex, nor a healthy bark-renewal. We recommend the cutting out of the poorer trees, even if the resulting appearance of the field be irregular, rather than the cutting out of every second or third tree in the endeavour to conserve a mathematical precision of alignment.

RUBBER CONTRACTS.

An interesting feature of the Newlands Estate is the system of rubber contracts by which the cultivation is now being extended. The estate does the felling of the forest and the draining of the land, and supplies the contractor with rubber plants from its nursery. After five years the contractor receives 20 cents for each well-grown rubber tree, planted 14 feet by 14 feet.

In the same neighbourhood a useful experiment is being conducted by Mr. Rogers, the Forest Officer, on a clearing in the Central Range Reserve. It comprises 210 Hevea trees planted from stumps on a slope, at 20 feet by 10 feet, in 1910. In 1916 their girth averaged 15 inches at 3 feet from the ground, and their height averaged 35 feet.

Mention must also be made of the Santa Anita Estate in the County of Caroni. The Hevea trees (planted in 1900) though only 97 in number, are of special interest, because measurements of their girth and yield were taken by Mr. Carruthers who initiated tapping experiments in 1910. The results were published in the Minutes of the Board of Agriculture in August, 1912. See also *Bulletin, Dept. Agr.* IX, 1910.

LARGEST TREES IN THE COLONY.

No tapping appears to have been done since 1912. The trees have made excellent growth, and are now probably the finest group in the sland. The largest tree measures 70 feet in height by 72 inches in circumference at 3 feet from the ground. Other trees have girths ranging from 72 inches to 42 inches respectively.

In 1910 their average girth was 34½ inches; in 1916, the average had risen to 51½. Whilst referring to the dimensions of some of the oldest trees in the colony it may be mentioned that the oldest tree of all, about 40 years of age, is in the Royal Botanic Gardens, and has a girth of 117 inches at 3 feet from the ground.

HEVEA IN DRY DISTRICTS.

Wyaby Estate, near Carapichaima, is of twofold interest, first as a recent example of fairly extensive planting of Hevea on an area which had proved unsuitable for cacao, and secondly as an instance of the apparently successful growth of Hevea in one of the very driest districts of the island. We use the word "apparently" not in any disparaging sense, for the cultivation is extremely promising; but because it is impossible to pass a final judgment until a considerable proportion of the trees have reached the tapping age.

In some fields at Wyaby the rubber has been planted alternately with limes;—a useful experiment provided it is borne in mind that limes are a crop requiring light, air, and room for expansion, and must therefore be regarded as predominant in this partnership; and the Hevea gradually reduced in number so as merely to provide a very light shade.

At St. Augustine Experiment Station also Hevea has made a very good growth during very dry years, in an open and exposed situation. This suggests the possible suitability for rubber cultivation of a very large area of abandoned cane-land in this district. As some of these trees are of sufficient girth to be tapped now, the Department expects that data for a definite opinion should be obtainable this year.

HEVEA AND CACAO.

A noteworthy example of Hevea planted with other crops is Eureka Estate in the Peñal district. The trees (planted in 1907 and later) have made excellent growth. For instance, in one field, planted in 1910, successive girths of 34, 43, 22, 28, 18, 29 and 12 inches were noted in 1916. In another girths ranged from 12 to 43 inches. The trees average from 50 to 60 feet in height. Rapidity of growth both in girth and height has been quite up to the average in the East. The trees have, however, unfortunately been planted around the edges of cacao fields. This will make the cost of tapping and collecting latex considerably greater than if the rubber had all been planted in a single block. Here as elsewhere it will be difficult, unless some co-operative system be established, to deal economically with the preparation and marketing of the produce.

SOIL AND RAINFALL.

Hevea seems to suit most of the soils of the Colony, with the exception of Naparima. The tapping results at St. Clair and the good growth in Carapichaima seem to indicate that a heavy rainfall is not absolutely essential, provided that the sub-soil is such as to be easily penetrated to a considerable depth by the roots of the plant and maintains a fairly regular supply of water. In Naparima the sub-soil in many places is composed of an exceedingly stiff and impervious blue clay. Judged by actual results, no kind of rubber has succeeded or is likely to succeed in this district.

To anyone selecting land for rubber planting, St. Andrew and the other moist districts of the Colony are especially to be recommended. But our returns show that there are many other areas unsuitable for cacao where Hevea will succeed and may be confidently expected to prove a useful and remunerative crop. Particularly in the case of heavy soil, good drainage is as essential as in the case of cacao.

CULTIVATION.

IT might have been expected that, in a Report of this sort, the Committee would have devoted a Chapter of some elaboration to a historical description of the cultivation of Hevea, as practised locally, with special reference to such important matters as draining, pruning and cost of cultivation. Indeed, the Committee, at the outset of its enquiry, itself expected that such a chapter would be a matter of course. But no such description is possible. From the replies to our interrogatory, it is evident that the rubber industry here has been conducted on no organised basis. Plantings were begun in the fit of enthusiasm which encircled the tropics about 1905-6. Lack of knowledge and experience caused the enthusiasm to wane during the years of waiting. The advent of Mr. Carruthers and the rubber boom of 1910, caused another flutter of excitement, and small beginnings were again made. But the early death of Mr. Carruthers, and the gradual fall in prices from the high level reached in the boom-year, caused another reaction in local sentiment. The tendency, never wanting in Trinidad, to disparage, if not to discourage, any new undertaking, caused the pioneers to doubt the wisdom of their own venture. Rubber fields were allowed to revert to bush, or, at best, given an occasional cutlassing. Fields where rubber had been planted alternately with cacao, with the intention of cutting out the less profitable crop, when both reached maturity, were mentioned apologetically, and the rubber was either cut out and replaced by immortels, or else trimmed down severely. Little or no new planting was done. And the general impression left on the mind of the Committee is that of a right initial impulse, allowed to die down through lack of organization and knowledge, and of spasmodic attempts to get something in the way of revenue from the first expenditure without incurring the additional expenditure which alone could make such revenue possible.

There are, it is true, estates such as Non Pareil and Newlands which convey an altogether different impression. The Committee is confident that their owners will have the best of reasons for congratulating themselves. It is however, to be regretted from the Colony's point of view that no rubber estate pure and simple was formed in the early years of the industry. Had such an estate been formed, and directed for instance by one of the London or Edinburgh Companies, with sufficient capital to continue planting and cultivating through the 5 or 6 years of waiting, with adequate confidence in the rubber market to withstand adverse local criticism, and with capable local management, we have no doubt whatever that such an estate would have shown results quite up to the high average of the East. Freedom from all serious pests, lower freights, lower salaries are at least a set off to the higher cost of labour here.

DISEASES.

The only disease affecting *Hevea* locally appears to be the "South American Hevea leaf Disease." A valuable memorandum on this subject by the Mycologist to the Board appears as Appendix A. (p. 128.) There are no serious insect pests.

PLANTING DISTANCE.

We are strongly of opinion that planters have been apt to plant their trees too close. In the best Eastern practice ten years ago, rubber was usually planted at 17 feet by 17 feet (150 trees to the acre). Now it is seldom planted closer than 20 feet by 20 feet and plantations where trees are closer are being heavily thinned. Many estates are even planting at 24 feet by 24 feet.

Here at Non Pareil we saw a young field planted at 12 feet by 12 feet in pure rubber with Robusta coffee at 8 feet by 8 feet between, and at Verdant Vale a field of 9 years old rubber growing at the same distance.

When tapping becomes general, we cannot but think that bark-renewal will be very slow and the risk of bark diseases very great, unless a heavy thinning is effected and light and air are admitted in greater degree.

The Agricultural Department of the Federated Malay States now recommends a scale of trees per acre, as follows:—

140 trees to the acre (18 feet by 18 feet) is regarded as a maximum for young trees up to 7 years old.

From 7 to 10 years old, trees should be thinned down to from 90 to 120 to the acre.

From 10 to 15 years old, trees should be thinned further to about 75 to 90 to the acre, *never above 100.*

This scale must be understood as intended to bring fields already planted into conformity with the knowledge acquired by recent experience. But as stated above, new planting is now seldom done closer than 20 feet by 20 feet.

There is a strong objection, in the East, to planting, intentionally, more trees than it is intended ultimately to leave. When the superfluous trees are cut out, their decaying stumps provide breeding places for *Fomes semitostus* and white ants, which would spread to the living trees. On the other hand, the digging out and removal or burning of every stump, with its roots, is tedious and expensive. It is possible, however, that here, where these pests do not constitute a serious danger, closer planting may prove advantageous, *provided always that thinning is not too long delayed.*

As regards thinning out, the large and well managed Kuala Lumpur Estate in the Federated Malay States had an interesting experience. It was suffering from diminishing crops through overtapping. The management thinned the trees out leaving only 60 to 70 per acre, and in 1915 were getting up to 600 lb. of rubber per acre at a very low tapping cost, and their crops continue to be good.

It has been found that delay in thinning out causes bark disease and general unhealthy conditions. It is impossible to assert, *with certainty*, that when tapping becomes general, outbreaks of bark disease will also result here from over-crowded conditions. But we regard the probability as so great that we strongly recommend planters to lose no time in thinning out their plantations gradually to the above scale.

SOIL WASH.

It must however not be lost sight of that with trees planted so far apart as 20 feet by 20 feet and taking several years to cover the ground, the loss of soil through wash may be very great. Particularly has this been the case in the East where "clean-weeding" is practised to a degree unknown, undreamt of, in Trinidadian agriculture. In the East fields are always kept entirely free from any weeds; as soon as the first weed begins to appear, a gang of weeders is sent through the field. A strong prejudice exists among planters in the Federated Malay States against cover crops, as it is believed that these tend to foster white ants, a most destructive pest to rubber. Even an intercrop like coffee, popular on many rubber plantations in the Dutch East Indies, has not found favour in the eastern British Colonies. The inevitable consequence has been the rapid deterioration of soils by wash with resulting reduction of the yield of rubber. This has necessitated the "resting" of trees by eliminating certain fields from the tapping round altogether for periods more or less prolonged; also proposals for "terracing" the land to prevent wash, and for the application of artificial manures, certain—on a clean weeded soil if at all hilly—to be again washed out by the first heavy tropical downpour.

While on every other aspect of rubber cultivation West Indian planters have much to learn from Eastern practice we are of opinion that, in regard to wash, Eastern experience shows us what to avoid. While keeping our rubber trees at such a distance apart as to ensure the access to them of light and air we must protect soils from wash by the growth of either an intercrop or a covercrop or perhaps both. Our high cost of labour prevents the practice of clean weeding as understood in the East, so to some extent the low herbage, periodically cutlassed, prevents wash. This can best be supplemented by the growth of such an intercrop as Robusta coffee, and a covercrop like *Canavalia ensiformis*, the sword bean.

It is worthy of note that at Roxburgh estate, Tobago, in a series of plots—no manure, chemical manures and cover crops—*Hevea* trees have made the greatest increase in growth, as indicated by girth measurements over a number of years, in the plot having Indigo as a cover crop.

We deal elsewhere with the question of the mixed growth of Hevea and *Coffea robusta*, but we may here say that the coffee must of course not be planted so close to the rubber trees as to shade their stems to any extent. Moreover it is desirable that quite a large clearing should be left round each rubber tree in order to facilitate access for tapping. Robusta coffee thrives best on the lighter loamy soils; on heavier lands Arabian coffee may be substituted.

HEVEA AND CACAO.

Cacao as an *inter-crop* has nothing to recommend it. It only begins to give anything of a return when the Hevea shade becomes so heavy that the cacao has to be cut out. Both Cacao and Hevea moreover are subject to the same disease, viz.: *Phytophthora faberi*, the cause of Black Pod and Canker.

SWORD BEAN AS A COVER CROP.

As a green mulch or cover crop we have suggested *Canavalia ensiformis* or "Sword-bean," as it is locally known. Given the expediency of a cover crop at all it is difficult to think of any plant more suitable in young cultivation. Like most leguminous plants it adds nitrogen to the soil. Unlike other leguminous cover crops it is tolerant of a moderate amount of shade. It has very little disposition to climb, an inconvenient and indeed injurious habit of certain other plants sometimes recommended as cover crops. It makes a dense growth about 2 to 3 feet high, practically stifling all weeds and grass. It prevents wash. Its heavy crops of beans provide a wholesome and palatable human food.*

In the open it matures its beans in about 4 months from planting. Under shade the period is about 2 months longer.

WINDBELTS.

Certain plantations in exposed situations might perhaps have made better growth, had they had some protection from the prevailing wind. Windbelts for rubber are not so absolutely essential as they are for cacao; but still they are very desirable, especially in any exposed place, such as along a ridge. Hevea "winters" *i.e.*, throws its leaves very early in our dry season, and puts out its new foliage in March, when the drought and the trade winds are most severe. The young foliage in exposed situations is then scorched to the detriment of the tree, as without foliage the tree is unable to elaborate the food material essential to its growth. The slight shelter of a hedge of wild coffee, or hibiscus, is better than nothing, particularly while the rubber is still young, but such a hedge can scarcely be regarded as a serious "windbreak." The tonca bean might be more used than it is, and, in it well-developed branch-system and dense foliage the Angelin (*Andira inermis*) has much to recommend it. The Poix doux (*Inga laurina*) also should be much more used than it is for the purpose of windbelts.

TAPPING.

We saw tapping in actual progress at Non Pareil and Newlands estates. At Non Pareil ten tappers tap a task of 200 trees each, from daybreak till 11 or 11.30, at which time they return to gather up their cups, take in their latex, strain and coagulate it, and then return to the field in the afternoon to collect the scrap. The trees are tapped every second day from June to the middle of February. Knives made by Skelton of Sheffield were being used, and tin collecting cups of about 250 cc. capacity.

The tapping appeared to be carefully done, but we regret that the old full herring-bone system has been adopted. In the early days of rubber planting in the East, the full herring-bone system over half the tree was the predominant method. Indeed, the fatally exhausting 'fully spiral' system was its only competitor. As wound-response and bark-renewal have been more carefully studied, so methods of removing less bark from the tree, and giving a longer period for bark renewal have ever been adopted. First the spiral system went. The full herring-bone soon followed. The half-herring bone next had a considerable vogue. A period of four years was, even so recently as 1910, considered sufficient interval for bark renewal, before again tapping the renewed bark. Since then the simple method of the basal V has been introduced, but bids fair in its turn to be superseded by the so-called "single quarter cut," *i.e.*, one diagonal cut on one quarter, or on two opposite quarters of the tree. This cut leads into a permanent vertical channel, and the cup is always placed at the foot of the tree. The advantages claimed for this method are (*a*) its extreme simplicity, (*b*) that a labourer can tap a far greater number of trees, 300 and even 400 trees a day being a common task for expert tappers, (*c*) that instead of 4, a period of 7 or even 8 years is allowed before it is necessary to tap renewed bark, (*d*) that the proportion of 'scrap' rubber is reduced to a minimum.

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* For analysis, uses, etc., see *Bulletin Department of Agriculture*, xvi., 1917, 65-67.

All these reasons are equally valid here, indeed reason (*b*), with our higher rate of wages, is supported by a stronger argument still.

PROFIT PER ACRE.

The following valuable record of the actual cost of production of Para rubber in Trinidad was kindly contributed by Mr. E. A. Robinson, the owner of Non Pareil estate, where tapping was begun in 1914. (60)

"I find that to keep up rubber cultivation to a thoroughly efficient standard, and to pay for curing, tapping, machinery, superintendence, transporting, shipping and selling, the cost of one acre of rubber would be as follows:—

	$	c.
Draining and roundridging. (N.B.—This might be varied with forking every two years) ...	6	00
Brushing	2	00
Manuring	6	00
Superintendence	7	00
Machinery, curing, etc.	7	00
Tapping	40	41
Packages	1	00
Transporting		45
Extras	1	00
Shipping and selling (N.B.—I have account sales from London which work out, even with war charges, at 5 cents per lb. but I allow 6 cents).	15	28
Total	$86	14

"The trees on this estate are planted 14 ft. by 14 ft. giving 220 trees to the acre. As therefore the 1,200 trees gave 1,608 lb. of rubber, 220 trees or one acre gave 294 lb. This sold at 50 cents per lb. equals $147 per acre.

"The cost as I have shown, of cultivation, manufacture and sale of this rubber is $86 14 cents thus leaving a nett profit of $60.86 cents (£12 13 7) per acre.

"Should any one think that my close planting helps to make this profit large, and that in after time I may have to thin out the trees, and thus reduce the output per acre I can only say that in my opinion, as the trees grow older and I have to thin them out, they will increase their yield per tree; consequently the man tapping will collect more rubber from the same number of trees and therefore the cost of tapping will be proportionately decreased. It will be seen that the cost of tapping is almost half of the total cost of production and that consequently as the trees grow older, and increase their yield, and decrease in number, the cost of production ought to be considerably reduced."

At Newlands Estate tapping was done for the first time in 1916. 1,830 trees were tapped, full herring-bone with three cuts on each side, on alternate days between July 17 and December 16. One man marked out 100 trees a day—this of course only has to be done once for the whole season; One man tapped and collected the rubber from 200 trees a day. The yield was good at first but fell off later owing to a temporary attack of leaf disease (*see* Appendix A.) The total yield—sheet and scrap rubber—was 1,290 lb., or a little over 11 oz. per tree. The cost of production; including maintenance of the cultivation, purchase of tapping apparatus and materials, shipping charges, etc., was 26 cents per lb. and the realized profit 27·6 cents per lb. As the trees are planted 14 feet by 14 feet, *i.e.*, 222 to the acre, the profit was at the rate of $61.27 per acre. This result is strikingly similar to Mr. Robinson's (p. 108) which gives the profit per acre as $60.86. Mr. Robinson however has in addition to actual cost of maintenance of cultivation allowed $7.00 per acre for superintendence. The estimated profit per acre in British Guiana is $54. (59).

A summary of the expenditure and revenue, with a note by the Hon. Sir G. Townsend Fenwick, K.C.M.G., one of the owners, follows:—

NEWLANDS ESTATE—CROP 1916–17.

Tapping and preparation ...	$ 243 16	
Cartage to railway	1 23	
Iron Press, trays, cups, acid, &c. ...	39 75	
Maintenance of cultivation ...	48 13	$ 332 24
Revenue from 3 shipments ; net :—		
Per "Crown of Granada"—		
361 lb. at 2/8		
12½ „ „ 1/9 (scrap)	$ 197 91	
Per "Crown of Cadiz"—		
474 lb. at 2/6		
16 „ „ 1/3 (scrap)	244 63	
Per "Serrana"—		
362 lb. at 2/10		
16 „ „ 1/9 (scrap)	225 58	$ 668 12
	Profit	$ 335 88

Shipping weight 1,290 lb.
Selling „ 1,273 „
Cost of production per lb. 26·1 cents.
Realised, net „ 52·48 „

NOTE.—With longer experience of tapping and preparation, more efficient methods of both, larger quantities dealt with, and a return to the normal of existing exorbitant rates of freights and insurance, the cost delivered in United Kingdom will be greatly reduced.

July 16, 1917. G. TOWNSEND FENWICK.

TAPPING INTERVAL.

Another question, bearing very directly on the profitableness of rubber cultivation in Trinidad and Tobago is the interval between tappings. Should trees be tapped every day, or every second day, or every third day or even at longer intervals? The question is not answered by replying either, that a greater yield is obtained from daily tapping, or every second day, or, again, that Eastern practice has proved daily tapping to be the most profitable.

The cost of labour is much higher here than in the East, and consequently, even though daily tapping give a larger yield than at longer intervals, it is necessary to enquire whether the extra yield is sufficient to pay for the extra labour. On the other hand it would not be necessary for daily tapping to produce twice as much latex as tapping every second day, if the increased yield were still large enough to leave a paying balance over the increased cost.

On this most important problem, the experiments of the Department of Agriculture at St. Clair give us useful practical guidance.

The question has been dealt with recently by Mr. W. G. Freeman, Acting Director of Agriculture, in a paper "Notes on the Tapping of Para Rubber" (61) from which the following extracts are taken:—

"The question of tapping every day or on alternate days is a very important one which has to be settled in each country with reference to local conditions. In Trinidad, labour is more expensive than in the East and if the same, or approximately the same amount of rubber can be obtained by less frequent tappings, it would mean a considerable reduction in the cost of rubber preparation. Experiments have been conducted at St. Clair since 1912, to determine whether this is possible. Their results, so far obtained, which are given later, indicate that tapping at intervals of about four days will probably be the most profitable in Trinidad at any rate under conditions similar to those at St. Clair."

"In 1912 at the August meeting of the Board of Agriculture I stated that experiments would be undertaken to ascertain the best interval to allow in tapping operations, as explained in the following extract from the *Minutes* of the Board:—

"The Assistant Director said:—Work will also be carried out on Hevea trees to ascertain whether it is not more profitable to allow longer intervals to elapse between successive tappings. If the same or even a somewhat less amount of rubber, could be obtained with half the number of tappings it may be more advantageous than the present method of tapping every other day. The important question with regard to Hevea is lessening the cost of production and every possible means of doing this should be given a thorough trial."

"The reason for suggesting this line of work was that in Ceylon it had been found by experiments conducted by the Botanical Department that the total yield of rubber from Hevea trees over a series of years was greater when the interval between successive tappings was increased up to a certain maximum. There was also, by decreasing the number of tappings, a reduction in expense and in the rate at which the bark was removed. Also a longer interval was available for bark renewal, because if b. tapping every other day on a system which used up the bark of a quarter of the tree in one year, the same area would be tapped again after four years, it follows that, by tapping say half as often, the bark would only be used up half as fast, and consequently the same area would not be retapped for eight years. More recent results in Ceylon have not confirmed the earlier work and more frequent tapping is now considered preferable there so far as regards the amount of rubber obtained.

"To start the experiment, trees which had been tapped during 1911 and part of 1912 were selected and divided into three groups of five trees each, the average yield of which was approximately equal. These are designated in the following table Series A, B and C, and it will be noted that their average annual yield of rubber per tree, during 1911 when all were tapped every other day, was 2 lb. 8 oz., 2 lb. 8 oz., and 2 lb. 13oz. Full particulars regarding these groups of trees and their previous yields, etc., are given in a report by Mr. A. E. Collens, F.C.S., the officer in charge of the experiments in the *Minutes of the Board of Agriculture* for March, 1913. The leading idea of the experiment was to take these series of trees, which had given very similar yields during a period when all had been tapped at the same interval, viz., every other day, and to compare their yields over a series of years when they were tapped at different intervals; every other day as before in Series A, every fourth day in Series B, and every sixth day in Series C.

"Unfortunately, by a misunderstanding, an alteration was introduced into Series A and C, during the end of 1914, and the early months of 1915. It will not however affect materially the general course of the experiment. It will be seen by comparing the yields per tree in Series A, B and C, for the years 1912 to 1916 (the last being for only six months) that whether tapping was done every second, every fourth or every sixth day there has been very little difference in the amount of rubber obtained. The importance of this is obvious. It means that Series C trees are giving practically as much rubber as those of Series A, from one third the number of tappings, *i.e.*, at one third the expense for tapping, and with only one third as much bark cut away. The experiments will be continued along these lines for a further series of years, in order to see how the yields compare when the bark already worked is retapped. It is here that greater advantage from the longer interval is anticipated, as it is not improbable that bark which has had a longer interval of rest will yield better than that which has been tapped more recently. In this experiment the trees are all tapped on the half herring-bone system, extending around one quarter of the trunk. This was the favourite system in the East when the experiment was started and so has been continued. Any new experiments would now be carried out with fewer cuts.

"The following table compiled from the tapping records kept by Mr. Collens gives the result to June 1916. In addition to the experiment already referred to it contains the results obtained in Series D and E, and from the old parent tree. Series D and E were designed to test whether once a week was a suitable tapping interval. It will be seen however that the yields from every seventh day tapping are very low compared with those from every second day, and apparently this interval is too long. It is proposed in 1917 to reduce the interval in Series E to four days to ascertain what difference this makes, continuing Series D as at present.

"The old tree, about 40 years of age, has given a total of 65 lb. 6 oz. in four years, during the greater part of which it has only been tapped once every four or six days. The rainfall during most of the time has been very low.

TAPPING INTERVAL EXPERIMENT AT ST. CLAIR EXPERIMENT STATION.

YIELD OF DRY RUBBER PER TREE.

	Year.	Duration of Tapping.	Interval.	Annual yield per tree.	Rainfall.
Series B. 5 trees.	1911	6 months (VII-XII)	2 days	2 lb. 8 oz.	53·90
	1912	7 do. (I-III & IX-XII)	2 days	2 lb. 5 oz.	49·35
	1913	10 do. (I-IV & VII-XII)	2 days	3 lb. 3 oz.	39·53
	1914	5 do. (I-II & X-XII)	I-II 2 days X-XII 4 days	13 oz.	54·12
	1915	12 do.	I-IV 4 ,, V-XII 2 ,,	3 lb. 13 oz.	56·31
	1916	6 do. (in progress)	I-IV 2 ,,	1 lb. 7 oz. (6 months)	21·59 (6 months)
Series B. 5 trees.	1911	6 months (VII-XII)	2 days	2 lb. 8 oz.	53·90
	1912	7 do. (I-III & IX-XII)	I-III 2 days IX-XII 4 days	2 lb. 3 oz.	49·35
	1913	11 do. (I-X & XII)	4 days	3 lb. 2 oz.	39·53
	1914	12 do. (I-XII)	4 ,,	2 lb. 7 oz	54·12
	1915	12 do.	4 ,,	3 lb. 14 oz.	56·31
	1916	6 do. (in progress)	4 ,,	1 lb. 10 oz. (6 months)	21·59 (6 months)
Series C. 5 trees.	1911	6 months (VII-XII)	2 days	2 lb. 13 oz.	53·90
	1912	7 do. (I-III & IX-XII)	I-III 2 days IX-XII 6 ,,	2 lb. 2 oz.	49·35
	1913	12 do. (I-XII)	6 days	3 lb. 2 oz.	39·53
	1914	8 do. (I-VI & XI-XII)	I-VI 6 days XI-XII 2 ,,	2 lb. 6 oz.	54·12
	1915	12 do.	I-IV 2 ,, V-XII 6 ,,	3 lb. 10 oz.	56·31
	1916	6 do. (in progress)	6 days	1 lb. 4 oz. (6 months)	21·59 (6 months)
Series D.	1915	8 months (V-XII)	2 days	2 lb. 4 oz.	56·31
	1916	6 do. (in progress)	2 ,,	1 lb. 8 oz. (6 months)	21·59 (6 months)
Series E.	1915	8 months V-XII	7 days	13 oz.	56·31
	1916	6 do. (in progress)	7 ,,	9 oz. (6 months)	21·59 (6 months)
Old Tree	1912	7 months	2 days	22 lb. 13 oz.	49·35
	1913	10 do.	2 ,,	17 lb.	39·53
	1914	12 do.	I-X 4 days XI-XII 6 days	10 lb. 11 oz.	54·12
	1915	12 do.	6 days	10 lb. 0 oz.	56·31
	1916	6 do.	6 ,,	4 lb. 14 oz. (6 months)	21·59 (6 months)

VII-XII indicate months, *e.g.* July to December.

Two days interval in tapping means tapping on alternate days.

NOTE ADDED.—Since this paper was written further records are available. During the whole tapping season 1916-17 to the end of January—the yields per tree of series A B and C were as follows:

Series A tapped every second day	3 lb. 7 oz.
,, B ,, ,, fourth ,,	3 lb. 6½ oz.
,, C ,, ,, sixth ,,	2 lb. 6 oz.

These later results are in agreement with the conclusion previously reached that tapping every fourth day is the most profitable at St. Clair, as practically the same amount of rubber was obtained at half the cost for labour in tapping.

CARE OF TREES.

The whole latex system of the Hevea tree being in its bark very great care must be taken both to guard the bark from injury and to dress wounds that may have been accidentally made so that they may heal as quickly as possible. Not only therefore must great caution be exercised in selecting careful men for tappers, and in training them in correct methods, but also in dressing wounds with a mixture of crude oil and tar, as practised by the cacao planter. The object of such a dressing is two-fold to help the wound to heal, and to protect the wound from fungi and boring insects.

PREPARATION OF RUBBER.

If the whole of the Hevea planted in Trinidad could be brought together, it would scarcely aggregate the number of trees which compose a moderate sized plantation in the East. It is essential, therefore, both in order to minimise capital expenditure, and to standardise output, that no unnecessary rubber factories be erected. Distance, and difficulty of transport, obviously prevent the whole of the latex produced from being treated in one central factory. But, so far as possible, such a policy should be adopted. In the County of St. Andrew, for example, where the chief rubber estates are situated, it is eminently desirable that one central factory should deal with the whole output. The size and age of the Non Pareil Estate naturally suggest it as the site. Neighbouring properties would do better to spend money on the purchase of suitable vehicles for the rapid transport of their latex to Non Pareil rather than on the erection of independent factories.

Mr. E. A. Robinson of Non Pareil already contemplates the erection of a factory. Whether it becomes a "central" or not, depends upon mutually acceptable terms being arranged either for the treatment of the latex, or for its purchase. The machinery for the factory cannot be brought out during the war, but we suggest that the planters concerned should meet Mr. Robinson and discuss plans with him.

If the latex from adjacent estates is to be treated, the factory will require to be considerably larger than for Non Pareil estate alone. And, even though the machinery cannot be obtained now, the factory can be planned, the machinery specified and ordered, so that no time be wasted before getting it erected after the conclusion of peace.

A large number of trees throughout the district are already being tapped, thousands of others are quite large enough to be tapped. Others are rapidly approaching the girth of 18 inches at which tapping is usually begun. It would be equally unfortunate were these trees to remain idle and unremunerative longer than necessary, or were the rubber from them to be prepared in half a dozen different methods, equally imperfect. For thus their owners would not only obtain low prices for their own particular product, but help to spoil the reputation of Trinidad rubber in general. Even though our total output is small, at least let it be good.

"Smoked sheet" is the variety of rubber the production of which is becoming more and more general in the East. Production of "smoked sheet" should also be aimed at here. It has been found that sheet of a more uniform type can be produced, and at a lower cost, if latex is standardised each day to a definite rubber content. This then should also be kept in view.

The collection of the scrap-rubber deserves careful attention; and "scrap-washers" should be installed wherever the output is sufficient to warrant the expense.

For the latex produced on estates in other districts too remote to be brought into alliance with our "central" scheme, we recommend the adoption of the simplest and most economical arrangement whereby a fair smoked sheet can be produced.

There is a growing tendency on the part of British Rubber manufacturers to prefer their raw rubber as raw as possible, not partially worked up, or half manufactured, on the plantation. Little will be lost then by the adoption of a simple method of preparation, provided that it be a good method and uniform.

CO-OPERATION.

We are of opinion that in view of the small and scattered nature of much of the rubber cultivation of the Colony, it is highly desirable that local rubber growers should combine in their own interests to form a co-operative association, on the lines of the Trinidad Cocoa Planters Association. In fact if the industry is to be taken seriously, some such co-operation is essential.

We need scarcely emphasise the importance of united action in case of any outbreak of disease. In the adoption of a correct method of tapping, especially when tapping trees for the first time, combined action would be most helpful. In the preparation of rubber for the market, if good prices are to be obtained, combined action is imperative.

On July 29, 1910, the Board of Agriculture adopted the following recommendation of the Advisory Committee:—"When a rubber expert is required, the Board will engage one specially." The present Committee is of opinion that the time has now arrived when the services, for a limited period, of a thoroughly practical man, expert in tapping, and in the preparation and curing of rubber would be of the greatest value.

Pending the engagement of a rubber expert from the East, or failing such engagement at all, we think that it might be of assistance to owners of rubber cultivation, if the President of the Board were again to appoint a Standing Committee to deal with any future questions affecting this industry.

HEVEA AND COFFEE.

Dr. Cramer in his paper on the "Culture of Hevea in the Malay Peninsula" a translation of which appeared in the *Proceedings of the Agricultural Society, Trinidad and Tobago*, (54) writes:—

"In Java and Sumatra, and at present also in the Malay States, Robusta coffee is used more and more as a catch crop between rubber. Of all varieties of coffee, Robusta is certainly the most suitable for use as a catch crop. In many respects it is preferable to Liberian; for the latter only comes into full production after four or five years. This is so much the more important as in the ordinary way coffee must be cleared out after about five years for the shade of the Hevea grows too heavy and the coffee becomes unproductive. From the Robusta therefore, two or three full crops can be taken, from the Liberian only one. (1)

"The crop is much larger and the gathering and preparation come out cheaper; the principal advantage of Robusta as a catch crop is, that it comes early into production, after two years it gives a small crop, and after three years it is in full production. There are therefore the two advantages that the Robusta comes into production earlier and matures better than Liberian.

"In this respect we may refer to the planting of young rubber in old coffee gardens, a practice which is to be met within the Malay States and frequently in Java and Sumatra. In these cases the old coffee is still kept as a catch crop. This is also the case with rubber between tea, or in old cacao plantations in Ceylon, but these crops are not entirely suitable for the purpose; tea requires a too expensive installation and comes too late into production, and the same is the case with cacao, moreover the latter only gives much of a return when the Hevea shade becomes so heavy that it has to be cut out."

A very instructive local demonstration of the excellence of Dr. Cramer's advice may be seen at Non Pareil in a five-acre field. It is planted with Hevea at 12 feet by 12 feet and Robusta coffee at 8 feet by 8 feet. At the time of our visit, both species were two years old, and the rubber trees, with an average height of 25 feet, had an average girth of 12 inches at 3 feet from the ground. Their growth, therefore, had been excellent, while the coffee was already bearing quite a heavy crop.

As we have stated elsewhere, we regard Hevea planted at 12 feet by 12 feet as very much too close. The rubber in this field could safely receive a heavy thinning indeed. And the Robusta coffee will probably pay most of the expenses of cultivation up to the time when it has to be cut out or reduced to make way for the maturing Hevea. Even then, if the Hevea is thinned out, according to the Scale recommended on p. 105 there should still be room for a certain number of the best of the coffee bushes.

QUALITY OF WEST INDIAN RUBBER.

Messrs. Lewis and Peat, of Mincing Lane, were kind enough to examine critically the various exhibits in the West Indian Section of the International Rubber Exhibition of 1911, and submitted the following commercial report regarding them—(22 and 27.)

"The West Indies were represented at the International Rubber Exhibition by Trinidad and Tobago, British Guiana, Dominica and Jamaica. About 18 or 20 different estates sent samples, and the quality and variety of sorts exhibited showed a great improvement on those displayed at the last Show held at Olympia three years ago.

"*Hevea*—Practically all the samples were good and some compared very favourably with those from Malaya and Ceylon. The quality of the rubber without exception was satisfactory, but a little more experience must be gained, and a little more attention paid to the various stages of the preparation, especially the washing and drying. Many exhibits were spoilt by being insufficiently dried and others by being too resinous, many showing small particles of dirt and bark. The smoked biscuits from the Trinidad Botanic Gardens deserved special mention.

"*Castilloa*—Taken all round, the exhibits of these species were excellent, and the rubber prepared by Mr. H. S. Smith's new machine was as good as any yet produced from this tree. The two best samples shown were from Major Walker's estate, Easterfield, and Mr. Smith's, Caledonia estate, Tobago. These sheets showed what can be done with Castilloa latex, and we should think that this rubber would rank very close to Hevea if sent to the market as well prepared as these two exhibits. They were better than anything we have seen, either from Mexico or anywhere else.

"The Ceara samples were good but nearly all showed too much resin, but this might be entirely due to the tree being very young and to the insufficient washing after coagulation and before drying.

"The small samples of Landolphia, Funtumia, and Ficus shown by the Trinidad Department of Agriculture indicated that all three of these species give a very marketable latex; but we doubt whether their cultivation, where Hevea, Castilloa, or Ceara will grow with such good results as shown by the other exhibits, is advisable.

"All together the collection was most satisfactory, and although the West Indies are perhaps a few years behind the big plantation centres of Ceylon and Malaya, they are certainly coming along very fast, and in a few years will be able to compete. As to Castilloa curing we think that Mr. H. S. Smith and his colleagues are teaching the rest of the world how to do it, and if they can be sure of a good yield they will bring the cultivation of this species to a very high position in the rubber planting world.

"Naturally, until the production can be increased so that regular supplies can be relied upon, it is very difficult to obtain fair values, and with such small and irregular parcels, both as regards quantity and quality, prices from time to time are most erratic and cannot be fairly quoted as the intrinsic value of any one of them against either wild Para or Plantation Para cultivated with success in the Middle East."

Central American Rubber—Castilloa elastica.

Castilloa elastica, a native of Southern Mexico, Central America and Peru, was introduced into the colony about 1880 when three plants were received at the Royal Botanic Gardens. Mr. Prestoe, Government Botanist, in his Annual Report for 1882, p. 30 remarks: "The giant dimensions of the tree leave it of less promise as a tree for cultivation than the Ceâra or Para rubber indeed, except for planting out as components of forest growth their culture cannot be thought of economically." (62) By 1885, however (63). Mr. Prestoe had so far modified his views as to write "It [Castilloa] may, therefore, be regarded as one of the few trees which while being of permanent use as a shade or shelter tree for cacao, bear promise of yielding an auxiliary produce of some value.

"As a shade tree, however, its characteristics and value have yet to be fully tested and proven, and in this view it is now recommended for planting experimentally on estates here. Its rapid growth, abundant and perennial (*) leafage borne on branches forming a regular and somewhat lofty head suggest suitability: on the other hand its manner of rooting, its effect on the soil, and consequent effect on neighbouring cacao trees, which

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(*) Whilst young plants may not drop their leaves; older trees in this colony are entirely bare during the dry season. Mr. Prestoe had experience of young plants only, as he retired in 1886.

is perhaps the most important point to be considered in respect to shade trees of any sort, can hardly be judged of except by actual trial, and this might be made for decisive issue in a few years by planting a few trees on various cacao estates. Indeed since its suitability will mainly depend on a habit of *deep rooting*, it might be judged of in a large measure, after a few months growth."

The first seeding of trees in Trinidad was reported in 1888, when plants were offered for sale at "$1 per pair." (65.) The first shipment of Castilloa rubber in marketable quantity was in 1902 from Tobago, and 1906 from Trinidad (85).

Reference has already been made in this report to the encouragement subsequently given to *Castilloa elastica* which resulted in its becoming the most extensively planted rubber tree in the colony. In the return compiled by Mr. Carruthers in 1910, from enquiries made from planters, the number of trees of this species was given as 600,000. The number now reported, in replies to our circular is 81,975. The latter figure as explained on page 96 is certainly much too low, and the former figure is probably too high (see Appendix B).

The figures agree, however, in indicating that a large amount of capital has been expended on planting Castilloa.

Castilloa has been planted on a large scale intermixed with other crops, principally cacao, and also as a pure crop. It will be of advantage to deal with these two methods of cultivation separately.

CASTILLOA AS A PURE CROP.

Examples of Castilloa as a pure crop are to be found in various districts. Cultivations in Naparima show clearly that the plant is quite unsuited to open lands exposed to the strong winds of this comparatively dry area. On one estate trees 8 years old on ordinary cane lands were only 25 feet high, and 15 to 18 in. girth. (Appendix C.) Similar results can be seen in Tobago.

In more sheltered places, provided there is a good depth of soil, they have done better. At Plaisance estate, Guaracara, Castilloa has been planted right over a low hill. On the lower slope of one side their average girth was 26 in., and on the corresponding position on the other side 29 in. whilst the trees at the top were only 14 in.; all were of the same age, about 16 years. (Appendix C.)

At Cedar Grove, Naparima, Castilloa similarly planted, died out completely on the hill tops leaving these bare, encircled by a ring of trees, decreasing in size and vigour from the rich black bottom lands upwards, and poor even there.

Even in such a moist locality as Tamana, at Monte Cristo estate, trees on the hill tops are also very stunted, whilst elsewhere on the same estate Castilloa has made excellent growth, both interplanted with cacao and alone. This estate shows an example of Castilloa as a pure crop planted originally in high woods merely cleared of undergrowth. These are now at 10 years old about 60 feet in height with an average girth of

17 inches ; the range being from 7 to 26 inches. The heavily shaded condition has caused them to run up and they would benefit by a reduction of shade. For example, trees on the same estate, without such heavy shade have an average girth of no less than 42 inches at 15 years of age.

The essential conditions for Castilloa thus appear to be a good depth of soil, capable of maintaining for the plant a regular water supply, and adequate protection from wind and sun.

CASTILLOA AND CACAO.

Castilloa and Cacao interplanted are to be found throughout the Colony. The opinion is widely held that the two plants do not thrive together and that the Castilloa injures the cacao. This opinion, combined with the fact that Castilloa has not given the yields which planters were led to expect has caused a violent reaction against this plant. On many estates Castilloa trees have been ruthlessly cut down, probably in thousands, during the last few years, as being not only worthless in themselves, but absolutely injurious to the cacao amongst which they were growing.

From a careful examination of the evidence the Committee has come to the conclusion that this condemnation is too general and that in suitable districts, planted under suitable conditions, and properly treated, Castilloa and Cacao thrive together, do not injure each other and each yields a remunerative return. Four actual examples from prominent estates will serve to demonstrate this point.

At Verdant Vale Estate, near Arima, County of St. George, three fields of cacao with both Immortels and Castilloa are amongst the best yielding fields on the estate. The Manager, Mr. F. Seheult has kindly supplied the Committee with the returns on the following page :—

Return of 3 Cacao Fields planted with Castilloa Rubber 5 years, 1912-13 to 1916-17 (June 25.)

No.	Name of Field.	No. of Cacao Trees.			No. of Immortel trees.	No. of Rubber trees.	Yield of Fields for Year. Barrels of 110 lbs.					Average No. of bags per 1,000 bearing trees.	Remarks.
		Full bearing.	Half bearing.	Supplies.			1912-13.	1913-14.	1914-15.	1915-16.	1916-17.	Bags (165 lb.)	
1	RiverPass No. III ...	1,840	110	61	114	470	22	$21\frac{3}{4}$	$17\frac{1}{8}$	$20\frac{5}{8}$	$23\frac{5}{8}$	$7\frac{1}{2}$	The year 1916-17 is not yet closed—there being 3 more months to complete period of reaping, viz.: 30/9/16 to 30/9/17.
2	River Pass No. IV ...	1,138	89	41	66	320	$17\frac{3}{4}$	$19\frac{3}{8}$	$12\frac{7}{8}$	$13\frac{7}{8}$	$15\frac{3}{4}$	$9\frac{1}{3}$	
3	Big Hill No. IV ...	1,207	38	96	75	139	$22\frac{1}{8}$	$30\frac{3}{8}$	$27\frac{3}{8}$	$23\frac{1}{8}$	$29\frac{3}{4}$	$14\frac{2}{3}$	
	3 Fields	4,185	237	198	255	929	$67\frac{7}{8}$	$71\frac{1}{2}$	$57\frac{3}{8}$	$57\frac{5}{8}$	$68\frac{1}{8}$		

NOTE.—The average weight of a barrel of cacao has been 110 lb. of dry cacao.

The year 1914–15 has been a very bad year, shortage has been 30 per cent. lower than previous years.

The age of Castilloa rubber planted in the 3 fields mentioned above vary from 5 to 9 years. Castilloa rubber seems to affect the yield of cacao between the ages of 4 and 6 years, when they attain the height of an average full bearing cacao tree.

(Sgd.) F. SEHEULT.

Verdant Vale Estate,
June 25, 1917.

Secondly, at Monte Cristo Estate, Mr. H. Monceaux has fields of cacao inter-planted with Castilloa and Bois Immortelle. The cultivation is now sixteen years old. The cacao has not suffered in any way as is indicated by the owners' comment quoted below :—

Field No. 40.—Castilloa 30 ft. x 30 ft. Immortels 30 ft. x 30 ft. Cacao 15 ft. x 15 ft. "One of the best yielding fields of cacao."

Fields 43 and 55.—Castilloa 15 ft. x 30 ft. Immortels 45 ft. x 30 ft. Cacao 15 ft. x 15 ft. "Good yields of cacao."

The Castilloa has also been tapped fairly regularly, according to market conditions, and the average cost of collecting and preparing the rubber (ball scrap) has been 13 cents per pound.

The third example is Roxburgh Estate, Tobago, where Mr. R. Bruce Archibald has a large field of cacao, on the flat, planted 16 ft. x 16 ft. with no Bois Immortels (*Erythrina* spp.) excepting some as a wind break on one side, the cacao being shaded by Castilloa alone planted 32 ft. x 32 ft.

Returns from this field have been accurately kept for some years as it has been divided up into seven plots with about 78 trees in each of which the "natural yield" is being obtained with a view to using the plots for experimental work later. The results have been published regularly in the *Bulletin of the Department of Agriculture.* The last return in Vol. XV, 1916, 203 gives the yield for the three years 1912–13 to 1914–15. The cacao is now 14 years old. In 1915 the lowest yield (plot 3) was an average of 47·22 pods per tree or 23 bags per thousand, and the highest yield (plot 1) 64·9 pods per tree or 33 bags (of 165 lb.) per thousand.

Fourthly, from Richmond Estate, Tobago, (Capt. M. Short) similar returns of plots of mixed Castilloa and cacao have been periodically published. The most recent (*Bulletin* XV, 1916, 140–1) shows for the no manure plot yields of 13, 10½, 10½, and 14 bags (of 165 lb.) per thousand trees during 1912 to 1915. The trees were 11 years old in 1911 when the records were first taken.

On the other hand there are without doubt examples in the Colony of the mixed cultivation of Castilloa and cacao which have proved anything but remunerative; the yield of the cacao is stated to have been poor and not compensated for by the returns from the rubber. The causes of failure probably differ in different cases, but the general impression left on the Committee is that the principal cause was overcrowding. Take as an example one estate in Trinidad in which Castilloa and cacao had been cultivated together on a large scale, there were Immortels at 36 feet x 36 feet with Castilloa between at 18 feet x 18 feet, and cacao at 15 feet x 12 feet, *i.e.*, to the acre about 242 cacao trees, and about 160 Castilloa and Immortels to shade them (in a wet district where only a light shade is really needed) and also to compete for nourishment from the soil. No wonder cacao under such circumstances has done badly. It would have fared badly had it been so densely shaded with immortels alone, and would have improved greatly had a great number of them been removed. This would not however prove that Bois Immortel and cacao do not thrive together. The course which recommends itself to us under such circumstances is not the sudden and wholesale destruction of the Castilloa, but the removal of some of the Bois Immortels, the periodical trimming of those left, and the judicious thinning out of the Castilloa, so as to leave the medium shade suited to the local conditions.

TAPPING.

A large amount of work has been done in Trinidad and Tobago as well as in other countries in attempting to find good methods of tapping Castilloa and preparing the rubber. The ideal method has not yet been found and possibly never will be. Castilloa is curiously different from Hevea in most important points as regards tapping. Hevea responds to steady tappings, at short intervals, of a small area of the trees; gives a low yield for the first few tappings, increases rapidly to a maximum, and then maintains that over a greater part of the tapping season.

Castilloa does not respond in this way. A cut apparently bleeds a considerable area of the bark, and a second cut made near it within a brief period yields little or no latex. The tapping systems of Hevea based on frequent paring at short intervals, of the edge of the cut, are thus impossible. In addition the coarse stringy bark of Castilloa gapes very much after being cut, and the wounds take a very long time to heal up, resulting after a very few tappings in the surface of the trunk becoming very irregular making latex collection from a number of cuts difficult, as any central channel system, as with Hevea, is not practicable.

These are some of the difficulties which have had to be contended with in tapping Castilloa, difficulties due to characteristics of the plant itself and incapable of alteration. As a result tapping of Castilloa has been done by (1) a large number of V shaped cuts, made with a thin bladed chisel and mallet with a collecting cup stuck into the bark at the apex of each V, or (2) a large number of cuts made with a chisel or cutlass and the collection of the latex on an apron fitting close about the base of the tree and spread out like an umbrella upside down, by means of short supports, so as to catch the falling latex. Both methods are somewhat troublesome; the latter is also cumbrous and wasteful of time and labour.

The latex, however collected, was prepared as sheet rubber by a creaming process. Good quality rubber was obtained, was well reported on and readily sold (88).

Later Mr. H. S. Smith of Caledonia Estate, Tobago, devoted his engineering ability to inventing a Centrifugal machine which earned good reports as the result of practical trials at the International Rubber Exhibition, London, 1911. (89), (91) and (93). It was adopted and used at the Louis D'Or Estate, Tobago and in the course of 15 minutes, dilute latex to which juice of the moon flower (*Ipomea Bona-nox*) had been added was converted by it to sheet rubber. A ready and efficient means of dealing with the latex was thus provided, but the difficulties of obtaining the latex remained. Mr. Smith was also commissioned by the Board of Agriculture to visit Mexico, as the result of which a valuable report was obtained which in particular showed that the high yields reported for Castilloa were entirely imaginary. (*See* (97) for summary of report.)

Most planters who tap Castilloa now, have abandoned the preparation of sheet rubber. The preparation of scrap Castilloa as described below is cheaper, and although sheet rubber commands a higher price the difference is not sufficient to warrant the extra expenditure entailed in collecting the latex and preparing the rubber.

To prepare scrap rubber the ground at the foot of the tree is cleared of weeds and some large leaves, *e.g.* bananas or balisier (*Heliconia Bihai*) laid down to catch any latex which may fall. Cuts are then made at intervals of about one foot to a height of 10 or 12 feet, on one side of the tree, with a chisel and mallet, or more quickly with a cutlass. Usually oblique cuts are made from below upwards, so that the gaping edge forms an eave over the wound and prevents water from lodging in the cut. Mr. R. S. Reid of King's Bay, Tobago, reports that a slicing cut removing entirely a portion of the bark yields well and leaves a wound free from gaping edges which heals over much more quickly. Mr. E. T. H. Thomas of Merchiston, Tobago, makes a double cutlass cut completely removing a narrow strip of the bark and reports similar advantages over the mere single incised cut.

Tapping for scrap is principally practised in moderately dry weather, when the latex does not flow so freely, and most of it coagulates on the bark. After an interval, varying on different estates from two to five days the rubber is collected. Two methods are followed. The scraps are simply pulled off, in irregular pieces, which are subsequently picked over to free them from pieces of bark, etc., allowed to " cure " for a few weeks, packed in sacks and exported. On other estates and perhaps the majority, the scrap rubber is wound off the trees into balls, keeping the strings taut during winding. The balls are made of about 1lb. in weight.

At Monte Cristo Estate, Cumuto, in a wet district, Mr. Monceaux taps through a considerable part of the year, stopping for two or three months in very dry weather, and also on rainy days when the latex would be washed down the trunk and lost. He collects the rubber two days after tapping. When the trees are yielding well he finds that one man can bring in 4lb. of rubber per day, *i.e.*, tapping during part of the day and during the rest collecting, by winding into balls, the rubber from trees tapped previously. His cost per lb. of collection of the rubber has been as follows. 1910, 13½c.; 1911, 16c.; 1912, 19½c.; 1914–1916, 10c. The average cost during the whole period has been 13c. per lb. Two men make the round of his trees in two to three months, and each tree is tapped three or four times in the course of the year. The average yield per tree is about 4½ oz. At El Rosario Estate, Poole, 2,000 trees planted in 1900 were tapped in 1908–09—150 daily, with chisel and mallet, each tree being tapped four or five times during the season. The total yield was about 8 oz. per tree and the cost of collection 12c. per lb.

Very interesting results have been supplied by Captain Short, of Richmond Estate, Tobago, who was the first to take up the cultivation of Castilloa on an extensive scale in the colony. He has about 7,000 Castilloas, 3,000 near a river or stream and 4,000 on hilly land. They were planted between 1899 and 1912, chiefly amongst cacao. Returns of the cacao from one of the fields have been given earlier (p. 120.) Tapping for both sheet and scrap rubber has been conducted as already described. The average cost of tapping and collecting the rubber has been 20 cents per lb. for sheet and 6 to 8 cents per lb. for scrap rubber.

The prices obtained have been as follows :—

	1903.	*1904-05.*	*1906.*	*1907.*	*1908.*	*1909.*	*1910.*	*1911.*	*1912.*
Sheet	72c	84c.	$1.04	96c.	82c.	$1.00	$1.47	78c. to $1.09	84c. to $1.06
Scrap	...	...	84c.	90c.	...	...	96c.	84c. to 86c.	72c. to 88c.

In 1906 the average yield from the older trees was recorded as 8 to 12 ounces per tree.

" From 1903-1912 " Captain Short writes, " The average nett proceeds per lb. were 2/6 for sheet, and about 2/9 for scrap, after deducting all expenses for tapping, collecting, drying, and shipping and sale expenses."

There is a difficulty at present in disposing of quantities of scrap rubber, too small to be worth exporting separately. This may be overcome by the formation of a Rubber Growers Association as suggested on p. 114, or by the Cocoa Planter's Association dealing in rubber, although even this may not quite meet the case. What is required is a local market, at a reasonable price, for small quantities of Castilloa scrap, so that the man with only a few trees can tap them and dispose promptly of the produce. The following memorandum from Mr. A. E. Collens to the Acting Director of Agriculture summarizes the results of enquiries made in this direction in September 1916 :—

I have seen Mr. Forjonel (of Messrs. E. Forjonel & Co.) and also Mr. C. F. Sumner (Messrs. Frank G. Alden & Co.) *re* the scrap Castilloa samples you gave me.

" Mr. Forjonel, who purchases balata on behalf of the Irwell and Eastern Rubber Co., Manchester, states that he could not at present estimate the cost of freight, etc. from the South of England to Manchester. He is however forwarding one ball as a specimen to his principals asking for information as to whether they would care for him to buy local rubber and in what quantity. Should they agree he will then be in a position to make an offer.

" Mr. C. F. Sumner purchases balata chiefly on behalf of W. H. Stiles, a New York broker, to whom he is also forwarding a ball of scrap and asking for information on similar lines as Mr. Forjonel. If the reply is satisfactory he would be in a position to purchase locally.

Both Mr. Forjonel and Mr. Sumner want to know whether such supplies of scrap would be regularly offered and whether they could count on a fair quantity, as it would not pay them to handle a sporadic lot of say 20 or 40 lb. They also enquired how much of the present lot was available. I informed them that the Department and Board were both trying to enthuse the industry and had recently made a census of the rubber cultivations and that it was very likely that tapping and curing would soon be started on a fairly large scale."

The African Rubber Tree—Funtumia elastica.

Funtumia elastica, Stapf. is a large tree native to the forests of Tropical Africa ; at first it was known only from West Africa, but within recent years it has been found also in Uganda and British East Africa

It was introduced into the Colony through the Botanic Gardens about 1895 under the former name *Kickxia africana*, Benth. It flowered first in 1899 (103). Two species were formerly confused under the one name. They are now separated and known as *F. elastica* and *F. africana* respectively. The former has a short broad pod, and the latter a long narrow pod. The former yields good rubber, the latter is of no value as a rubber plant (106). Both were originally in the Colony, but the Botanical Department had the plants throughout the Colony inspected in 1902 to ensure that no *F. africana* were being cultivated: none were found.

Funtumia elastica has nowhere proved very successful as a cultivated plant, although naturally it has been worked on a considerable scale in localities where it occurs wild, as in the Gold Coast Colony and in the Mabira Forest, Uganda. In the first place it is very liable to be blown down, due apparently to a disease of the root; it suffers from this cause both in its native habitat and also when cultivated in the West Indies and elsewhere. Its yield of rubber, per tree per annum, is low compared with Hevea, but against this is the fact that it can be planted much closer, and advocates of Funtumia claim that the yield per acre may equal that of Hevea. Even, however, in the West Coast of Africa where it is native, preference is now given to Hevea as a rubber plant for cultivation. In the Cameroons where large plantations were established, the extension of these was stopped some years ago and Hevea planted instead. It may be preferable in West Africa in places too dry for Hevea, or where, owing to labour difficulties, the regular and frequent tapping necessary for Hevea is not practicable.

In Trinidad and Tobago Funtumia has been tried on many estates, but only on a very few has it been taken up on any considerable scale; the oldest plantation being at St. Marie Estate, Cedros, with about 10,000 trees on 38 acres planted from 1904 onwards. The original Cedros trees were planted 6 feet by 6 feet; in traces cut through forest growth; subsequent plantings were on cleared lands, they are now 12 feet by 12 feet. 25,000 trees are reported from Haleland Park Estate, Maraval, but they are young.

The Committee is unable to recommend any further extension of the cultivation of Funtumia, especially as satisfactory growth and yield of Hevea are obtained in Trinidad in even the drier districts where experiments have been made. Should anyone, however, wish to grow Funtumia the trees should be planted closely at first, say 6 feet by 6 feet to prevent them branching freely and developing a shrubby habit, and gradually thinned, as they form trunks, to at least 12 feet by 12 feet.

TAPPING.

One of the best methods of tapping Funtumia appears to be that recommended by Christy in *The African Rubber Industry*, which has been tried experimentally at Cedros. By the aid of a short light ladder a *shallow* central cut is made from a height of about ten or twelve feet to the base of the trunk, where a collecting cup is placed in position. Inclined lateral cuts about 9 inches apart are then made half way round the tree from each side of the central cut alternately, to form a double herring bone. These cuts are also made very shallow, merely to form channels for the latex, which is caused to flow by running a wheeled pricker in each cut so that its thin blades penetrate through the bark.

A special "Christy" knife is used for the wokr. The latex runs very freely. The one tapping drains a considerable area each side of the cuts, and only two or three tappings each year can usually be made. At the next tapping a new central channel is cut close to the previous one and new lateral cuts made. These have to cross the former set, but if the directions to make them very shallow have been followed. this does not interfere with the flow of latex.

The usual methods recommended for coagulating Funtumia latex are heating and the use of formalin. Neither appears very satisfactory. Mr. A. E. Collens, F.C.S., of the Department of Agriculture, carried out some investigations and as the result of many experiments recommended lysol as a coagulant (110.) This method was tried at Cedros in 1912, 1913, and again this year. The latex is first diluted with about an equal quantity of water. The lysol in the proportion of one part for every 100 of original latex is then added. This is done by diluting the lysol with about 100 times its own volume of water and pouring it into the diluted latex, stirring the whole time. The dish or basin is gently rotated so as to ensure uniform coagulation and then set aside. After a few minutes the rubber begins to separate from the watery fluid and in 5 or 10 minutes has coagulated into a biscuit which can be gently lifted out with a bone or wooden spatula, leaving a clear amber or light brown fluid behind; it can then be rapidly rolled out into a thin biscuit and washed in water. The result is a snow-white biscuit of even shape and pleasing appearance, very resilient and tough. With delicate manipulation the rolling can be quickly completed; the principal point to be observed is the avoidance as much as possible of handling the clot of rubber as the human touch seems to cause hardening.

The product is strong and of good elasticity. It has, however, a great tendency to become tacky in drying, a tendency greatly reduced by smoking but not got rid of altogether. Further work on the preparation of Funtumia rubber is evidently necessary.

Mr. Thornton Warner has recently been experimenting with Funtumia and prepared a very good sample in the following manner as described by him in a letter of January 21, 1917:—

"The latex, after being collected in a larger vessel, is taken to the works and left undisturbed until the following morning, when water is added equal to half the quantity of latex and thoroughly mixed; when the sun has gained the full strength, the mixture is poured on to a smooth wooden surface and allowed to remain in the sun for three hours when it is practically cured; it is then rolled off into a ball. Before being rolled off the rubber looks dark, but when the ball is complete it has a grey and silky appearance.

"On the recommendation of the Government Department, I commenced treating the Funtumia latex with lysol, which made a good coagulant but the result was not satisfactory, the biscuits being very dark and unsightly and were not well reported upon by the London Brokers. I have recently shipped some of the balls under the new process and have asked for a special report on them of which I will inform you later."*

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* Mr. Warner arrived at this method quite independently, but since his letter was received we find that drying in thin sheets or boards has been tried previously (*see* 109.)

Summary of Recommendations.

I. *Hevea :*

1. That, as the results upon certain plantations here have proved equal to those obtained on average estates in the East, the Hevea Rubber industry deserves every encouragement in suitable districts.

2. That, while it is unlikely that the Rubber industry will ever occupy so important a position among our industries as Cacao, Sugar, or Coconuts, it should undoubtedly be in the front rank of our secondary industries, such as Limes, Rice, and Coffee.

3. That trees should not be planted closer than 20 feet x 20 feet and should thereafter be thinned out according to the scale suggested in our report.

4. That Coffee, especially *Coffea robusta* is the most suitable inter-crop for growing between the Rubber trees.

5. That protection from wind, though not so essential as in the case of Cacao, is nevertheless very desirable.

6. That, especially on hilly lands, it is expedient to protect the soil from "wash" by planting a cover crop.

7. That good drainage is important.

8. That the "Basal V" be adopted as the standard system of tapping for young trees, to be followed later by a single cut on a quarter of the circumference.

9. That a tapping interval of four days is suggested by the experiments of the Department of Agriculture as the most profitable locally; but that further experiments of intervals of two, three and four days should be made on each estate, and are being continued by the Department.

10. That the use of earthenware tapping cups is to be preferred to tin, as the former are not liable to rust, and being made without angles are easier to clean. Cost 15/- per gross.

11. That co-operation among rubber growers is requisite:
    (*a*.) for the purchase of knives and cups, and
    (*b*.) the standardisation of tapping methods, as well as for
    (*c*.) the co-operative production of rubber of an uniform type, and of the most marketable quality.

12. That a local Rubber-Planters' Association be formed, or (better still) that the existing Cocoa Planters' Association deal with rubber as with cacao.

13. That, as recommended by the Board of Agriculture on August 29, 1910, a rubber expert be obtained from the East.

14. That, pending his arrival, a Standing Rubber Committee of the Board be appointed.

II. *Castilloa:*

1. That the planting of Castilloa as a pure crop is not profitable anywhere.
2. That the further planting of Castilloa even as shade for Cacao is inadvisable, except on or near estates where it is already proved that Castilloa can be so grown without injury to the Cacao crop, while returning some revenue itself.
3. That where Castilloa has already been established and makes vigorous growth, it will pay to tap it.
4. That the right method of tapping Castilloa has never been found, and probably never will be found: but that further experiment is desirable; and that the Merchiston method should be watched with interest.
5. That the most profitable method appears to be tapping, two or three times a year, in dry weather, with the cutlass, and collecting the rubber four days later in the form of "scrap-ball."
6. That the cuts should be made about one foot apart, on one side of the tree only, and made obliquely *upwards*, in order to prevent rotting due to the entry of rain.
7. That, where Castilloa is alleged to injure cacao, such injury is frequently due to excessive shade, either of Castilloa alone, or of Castilloa *plus* immortels.
8. That, before, in such cases, condemning the Castilloa off hand, it would be well to try the effect on the cacao of the reduction of shade.
9. That the tapping of isolated Castilloa trees in certain places might be profitably conducted on similar lines to the bleeding of balata.

III. *Funtumia:*

1. That the further planting of this crop should be discontinued.
2. That while the method of sun-drying the latex may be used in the case of very small quantities, the lysol method of coagulation seems at present to be the best means of treating this latex upon a commercial scale.

NORMAN LAMONT,
Chairman.

W. G. FREEMAN.

AUCHER WARNER.

C. S. ROGERS.

July 19, 1917.

APPENDIX A.

The South American Hevea Leaf Disease.

By J. B. Rorer,
Mycologist, Board of Agriculture.

In July 1916, the attention of the writer was called to a disease of the leaves of Hevea trees, which was causing considerable defoliation on several different estates in widely separated parts of the island. Microscopic examinations showed conclusively that the disease was the so-called South American Hevea Leaf Disease, and from its general distribution, it must have been present in Trinidad for a number of years, but only became epidemic during July, August and September, owing to the climatic conditions which were exceptionally favourable for fungus growth.

This disease was first noticed in Suriname in 1910, and it was carefully studied by Dr. Kuijper, the Mycologist there, who published a report on it in 1912. At that time it had confined its attacks to nursery stock and young trees; while the older plantings seemed quite free from infection.

During the past four years, however, both in Suriname and in Demerara, the disease has spread rapidly to the older Hevea trees, and it must now be considered the most serious trouble of the Hevea tree in this part of the world.

Dr. Gerold Stahel, Mycologist of the Department of Agriculture of Suriname, has spent the greater part of his time during the past one and a half years in a careful and thorough study of the disease, and his full report is soon to be published. He has already issued two short papers, in which he states that it is caused by a fungus which has three different fruiting stages, only one of which, however, is instrumental in its spread. This form is known as a *Scolicotrichum*, and the spores are produced in great abundance chiefly on the underside of the *very young* diseased leaves. These spores can be carried by the wind, rain or insects; they germinate and penetrate the young tissues of the leaf very quickly, (ten hours) and in this way, are responsible for widespread epidemics, under suitable weather conditions. After fifteen hours drying, however, they lose their power of germinating.

The other two forms of the fungus occur on or around the edge of the spots on the older leaves. They appear as small, black pustules, similar in external appearance, but some contain spores of one kind, while others contain another type of spore. Dr. Stahel's researches show that these two types of spores are only very slightly capable of infecting the leaves, and may be entirely disregarded as a cause of the spread of the fungus.

Dr. Stahel states that very many of the rubber trees in Suriname are affected with this disease, and on parts of some estates, as high as twenty per cent. of the trees have been killed to the ground.

The disease is also widespread, virulent and epidemic in Demerara, according to the reports of Bancroft.

No successful means of combating the disease on large trees has yet been found. Where it attacks nursery stock or young trees in the field, it can be readily controlled by spraying with Bordeaux mixture.

The disease occurs in Trinidad in several different districts, and is more widespread than last year, though it is too early in the season yet to say how serious the attack is going to be.

I visited a number of different estates about six weeks ago, and found all the trees making new growth, and the young leaves, as a whole, were very healthy. In one or two places, however, where, curiously enough the disease was not very prevalent last year, the trees were suffering from a severe attack this year. One or two old trees have been actually killed as a result of repeated attacks, while quite a number of trees, two or three years old, have died on account of the repeated defoliations.

The disease does not seem to be so virulent here as in Suriname and Demerara, probably on account of less favourable climatic conditions for fungus growth; but still it must be considered a latent menace to the rubber industry, and some means for combating it should be searched for.

Spraying large rubber trees is practically out of the question, on account of the expense; and where this means of combating fungus pests cannot be used, a search for resistant individuals or varieties is the most hopeful solution to the problem.

Mr. C. B. Williams told me that he noticed in Demerara one field on an estate which had been entirely destroyed by this disease, except for three or four trees which were perfectly healthy and in good foliage. If these resistant trees are the same species of Hevea, an effort should be made to propagate from them, either by seeds, cuttings, grafting or budding, whichever way is most feasible.

In the East they are beginning to consider ways and means of selecting seeds for future planting from parents which yield the maximum quantity of latex. Some method should be followed here as far as possible, in selecting seeds, or in propagating in other ways, from resistant trees, if any are found.

In conclusion, although the disease has not as yet done a great amount of damage in Trinidad, it is widespread throughout the Island, and considering that it is actually destroying plantations in the neighbouring colonies of Suriname and Demerara, it must be regarded as a dangerous disease to the rubber trees in this Colony.

July 17, 1917.

Dr. Stahel's full report has just come to hand but I have not translated it yet.

J. B. R.

APPENDIX B.

Summary of Returns of Rubber Trees, Trinidad and Tobago, 1910 and 1916.

Estate.	HEVEA.		CASTILLOA.		FUNTUMIA.	
	1910.	1916.	1910.	1916.	1910.	1916.
Arima and Tacarigua:						
Verdant Vale	3,000	3,227	35,000	26,301	2,000	1,207
Arizona	...	3,600	...	...	...	900
La Gloria	...	38	...	...	...	...
Sta. Marta	100	1,000	100	...	100	
Ortinola	...	..	12	...	19,678	...
Morvant	150	...	1,250	...	...	...
Monte Cristo	50	...	25,000	...	1,200	.
El Dorado	...	...	462	...	...	...
Oropuna	...	...	...	...	1,000	...
St. Augustine Experiment Station	...	144	...	...	..	...
Esperanza	...	...	2,535	...	450	...
Trafford	...	...	2,000	...	...	...
Couva and Chaguanas:						
Brechin Castle	...	...	...	...	...	...
Camden	...	...	...	...	...	...
Concord	...	...	...	...	...	...
Esperanza	...	1,200	...	...	...	...
Hope	...	1,000	...	...	...	...
Waterloo	...	30,500	...	...	...	...
Itcarridonum	...	200	...	...	...	...
Chaguanas	250	. .	1,200	...	...	...
Longdenville	...	...	3,000	...	...	...
La Vega	...	...	400	...	...	...
Providence	...	...	120	...	...	...
Hillandale	120	...	5,000	...	100	..
Cocoloco	1,000	...	...	...	...	...
Forres Park	523	...	6,968	...	217	...
Tortuga	...	...	20,000	...	...	...
Diego Martin and St. Ann's						
El Lindero	...	700	...	...	...	...
El Reposo	...	175	...	...	...	...
Fonds Palmiste	75	...	...	...	5,500	2,400
Haleland Park	...	...	...	1,774	...	20,000
Horquette	...	...	...	...	...	...
Macqueripe	...	500	...	2,000	...	5,576
River Estate	300	105	200	...	300	...
Royal Botanic Gardens ...	2	270	205	149	...	...
San Antonio	...	493	...	2,009	...	...
St. Cecilia	774	200	9	...	2,013	...
St. Clair Experiment Station	161	160	1	1	88	...
Val de Oro	...	3,000	...	...	...	...
San Carlos	...	...	300	...	...	...
La Deseada	...	...	105	...	25	...
Mon Valmont	...	...	6	.	...	...
Manzanilla and Mayaro:						
San Leon Grande ...	...	100	...	690	...	...
Non Pareil	...	60,000	...	...	..	...
Newlands	11,000	8,659	5,000	3 053	1,500	171
Braeside	160	...	100	...	360	...

APPENDIX B.—*Continued.*

Estate.	HEVEA.		CASTILLOA.		FUNTUMIA.	
	1910.	1916.	1910.	1916.	1910.	1916.
Manzanilla and Mayaro—Con.:						
Cedar Hill	...	1,200	...	...	...	...
Lasafoir	...	2,300	...	...	...	...
St. Madlain	...	500	...	...	...	...
St. Helens	...	7,000	...	...	...	...
Evasdale	...	6,726	...	...	...	...
La Luisa	...	5,400	...	...	...	...
Los Almadillos	...	780	...	...	...	200
Grosvenor	...	...	50	...	...	...
Manzanilla	250	...	...	...	1,500	...
Plaisance	550	...	16,326	...	1,085	...
Enidsburgh	4,500	...	350	...	400	...
Naparima:						
Cedar Grove & La Ressource	...	...	...	3,768	...	...
Palmiste	...	655	...	200	...	...
Union	15,000	...	120	...	700	...
Eureka	6,000	5,000	...	...	...	...
Oropuche and Cedros:						
Adventure	...	...	...	300	...	50
Alta Gracia	...	800	...	200	...	...
Mon Espoir	...	...	...	...	...	...
Cedros, Beausejour	...	...	...	...	20,000	10,000
El Puerto	150	...	1,200	...	800	...
Savana Grande and Moruga:						
La Fortitude	600	...	...	...	...	...
Craignish	...	...	...	1,500	...	...
El Guayanapo	...	1,332	...	11,455	...	...
El Rosario	...	53	...	2,000	...	700
New Grant	...	...	2,076	5,000	...	...
Rio Claro	500	...	20,000	...	3,200	...
Santa Maria	500	...	2,000	...	...	...
Bonne Aventure	...	...	1,797	...	...	...
Henry	...	...	2,000	...	...	...
Tobago:						
Botanic Station	12	16	35	12	4	...
Greenhill	...	200	...	6,000	...	50
King's Bay	...	...	...	4,000	...	...
Lure	...	...	...	1,413	...	...
Merchiston	...	...	...	1,000	...	...
Richmond	...	...	...	7,000	...	...
Roxburgh	150	...	6,500	...	200	...
Speyside	...	...	...	3,000	...	...
Riverside	...	...	9,000	...	...	...

APPENDIX C.

Girth of Rubber Trees in Trinidad and Tobago.

The dimensions in this table are from measurements made by the Committee; the rainfall is the average for the number of years given in brackets in the same column, the first time of mention of the estate.

HEVEA.

Age in 1916.	Estate.	Rainfall.	Girth.		Planting distance.	Notes.
			Average.	Range.		
Years.			Inches.	Inches.	Feet.	
1½ to 2	Wyaby, Carapichaima	68 (14)	8	4–15	20 x 20	With limes 12 ft. x 12 ft. Formerly cacao and immortels; cut out 1915.
	Nonpareil, Sangre Grande *	109 (14)	10	17–13	12 x 12	Field "Martin."
	,, ,, ...	109	13	6–16	...	Large plants, planted May 1915. Field "Kissoon."
2	,, ,, ...	109	12	7–14	12 x 12	With Robusta coffee 8 x 8, bearing heavily.
2	Wyaby, Carapichaima	68	9	4–15	...	Field No. 3.
2	,, ,, ...	68	15	13–20	...	Field No. 2.
4	Dos Hermanos, Sangre Grande †	abt. 90	7	6–10	15 x 15	Flat land, subject to slight inundation.
4	Monte Cristo, Cumuto	98 (5)	13	9–16	...	Inter-planted with olde Castilloa.
5	Verdant Vale, Arima...	89 (12)	13½	8–18	...	Stumps, Department of Agriculture, Malayan seeds.
5	Newlands	90 (6)	14	7–23	14 x 14	Rubber contracts.
6	Santa Anita, Longdenville	...	22	15–26	...	Field No. 7.
6	Eureka Estate, Peñal	...	26½	12–43	...	Edge of cacao field "Big Garden."
6	,, ,, ...	...	27½	17–37	...	With cacao "Lagoon" field.
6	Govt. Central Range Reserve	abt. 90	15 14	10–21 9–19	20 x 10 20 x 10	
5–7	Non Pareil, Sangre Grande.	109	28	16–40	...	Field "Cipriani."
7	St. Augustine Experiment Station	51 (6)	19	10–28	24 x 24	Tapping began July, 1917.
7	Dos Hermanos, Sangre Grande	abt. 90	15	10–20	...	Rubber and coconuts; latter removed 1916.
8	Palmiste, Naparima...	60 (6)	14	8–19	12 x 18	Field 15.

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* The rainfall is given for Santa Estella estate which bounds with Non Pareil.

† Rainfall of Evasdale estate, the nearest where records kept.

APPENDIX C.—*Continued.*

HEVEA.—*Contd.*

Age in 1916.	Estate.	Rainfall.	Girth.		Planting distance.	Notes.
			Average.	Range.		
			Inches.	Inches.	Feet.	
8	Palmiste, Naparima ...	60	9	6–14	12 x 18	Field 15. Exposed to wind.
8	,, ,, ...	60	16½	11–21	12 x 18	Field 15. Sheltered from wind.
9	,, ,, ...	60	17	11–22	10 x 12	Field 14. Top of hill.
9	,, ,, ...	60	15½	5–22	10 x 12	Field 14. Bottom of hill.
9	,, ,, ...	60	17	5–25	10 x 12	Field 14.
9	Concord, Pointe-à-Pierre	65 (9)	19½	12–23	...	On flat land.
	,, ,, ...	65	23	15–24	...	,, ,,
9	,, ,, ...	65	16	14–18	...	Ascending hill side.
9	,, ,, ...	65	9½	4–15	...	On top of hill.
9	Eureka, Peñal ...	...	28	13–35	...	Field "Big Flat."
9	Non Pareil, Sangre Grande	109	31	21–39	...	Field "Lalla." From Ceylon seed, planted through cacao, which cut out January, 1915.
9	Dos Hermanos, Sangre Grande	abt. 90	17	8–23	...	
9	Verdant Vale, Arima	89	29	24–37	12 x 12	Field 4. Hevea as pure crop.
9	Newlands, Sangre Grande	90 (6)	27	17–39	14 x 14	Planted amongst cacao, which removed in 1915.
9	,, ,, ...	90	26	12–35	14 x 14	,, ,, ,,
10	Roxburgh, Tobago ...	94 (8)	35	26–44	15 x 15	Field No. 7. Bottom lands occasionally flooded.
13	St. Clair Experiment Station	58 (17)	24	16–31	8 x 8	
16	Santa Anita, Longdenville	...	51½	42–72	20 x 20	With cacao. Field 9. Average 34½ in 1910 *i.e.* 10 years old.
18	St. Clair Experiment Station	58 (17)	34½	21–49	24 x 24	Planted originally with Castilloa, which cut out after being overgrown. Tapped since 1910, annual yield about 3 lb. per tree. See p.
40	Roy'l Botanic Gardens (original tree from Kew)	65 (55)	86	...	Single tree	Average yield per annum 1912–16—16 lb. See p.

APPENDIX C.—*Continued.*

CASTILLOA.

Age in 1916.	Estate.	Rainfall.	Girths.		Planting distance.	Remarks.
			Average.	Range.		
			Inches.	Inches.	Feet.	
8	Bonne Aventure, Pointe-à-Pierre	54 (10)	17	11½-30	Irreg'lr	Near river bank, many cut out.
8	,, ...	54	9½	3½-17½	,,	Open land, no shade.
8	Craignish, Savana Grande	64 (8)	31	19-34	...	Old pasture land, hill side.
9	Poole	97 (16)	30	16-39	15x12	No. 2 Gold Field, with few immortels.
9	La Ressource, Naparima	60	20	12-30	12x12	Field 27.
9	Cedar Grove, Naparima	60	18	6-23	12x12	Field 24.
9	La Ressource, Naparima	60	26	18-32	12x12	Field 21.
10	Monte Cristo, Cumuto	98	17	7-26	12x12	Under high wood, underbrushed.
10-11	Verdant Vale, Arima..	89	42	28-53	12x12	Planted irregularly—distance approximate.
11-12	,, ,, ...	89	57	43-77	...	Field No. 4 with Cacao—Immortels originally 24x24. Fallen and replaced by Castilloa. Best yielding field of Cacao.
			25	17-37	...	Gravelly soil by river.
13	Roxburgh, Tobago ...	94 (8)	40	29-49	32x32	In cacao 16x16. No other shade.
15	Monte Cristo, Cumuto	98	42	25-52	...	With Hevea—3-4 years old.
16	Plaisance, Pointe-à-Pierre	ab't. 60	26	18-37	12x12 ((25-50)	One slope of hill.
16	Plaisance, ,, ...	,,	14	10-23	12x12 (25-50)	Hill top.
16	,, ,, ...	,,	29	19-46	12x12 (25-50)	Other slope of hill.
16	,, ,, ...	,,	28	17-35	9x9	Field No. 1.

APPENDIX C.—*Continued.*

CASTILLOA.—*Contd.*

Age in 1916.	Estate.	Rainfall.	Girths.		Planting distance.	Remarks.
			Average.	Range.		
			Inches.	Inches.	Feet.	
16	Santa Anita, Longdenville	...	28½	18-40	...	Field No. 7 bank of river through cacao.
16	Monte Cristo, Cumuto	98	34	27-42	15x30	Field 43, with Cacao 15x15 and Immortels 45x30.
16	„ „ ...	98	27	21-35	12x12	Field 40. Through cacao 15x15 with immortels, 30x30, one of the best fields of cacao.
16	„ „ ...	98	51½	36-68	15x30	Field 55 with cacao, 15x15. Immortels 45x30. Yield Cacao good.
17	Poole	97	46	28-61	18x18	With Cacao & Immortels.
18	St. Clair Experiment Station	58 (17)	73	...	...	Planted with Hevea of same age (which see). All the other Castilloas removed.

FUNTUMIA.

Age in 1916.	Estate.	Rainfall.	Average.	Range.	Planting distance.	Remarks.
9	Verdant Vale, Arima..	89	27	22-40	Irreg'lr	Planted in any open spaces through old cacac, also coffee later.
9	St. Marie. Cedros * ...	56 (17)	14	12½-25	12x12	Beausejour.
	„ „ ...	56	14	9-24	12x12	Contour—East to West.
to	„ „ ...	56	21½	8-35	12x12	Up slope—North to South
13	„ „ ...	56	20	14-27	12x12	Along top hill—East to West.
	„ „ ...	56	26	18-34	...	

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* Rainfall records from St. Marie for two years only were 51, with the Constabulary Station 54. The average for the Constabulary Station during 17 years is 56, which is given in the table.

APPENDIX D.

Bibliography.

PREPARED BY W. G. FREEMAN.

The following notes give a summary of the information contained in the more important papers, etc., dealing with the Rubber industry of Trinidad and Tobago. They have been arranged under subjects—General, Hevea, Castilloa, Funtumia, and Miscellaneous—and then in chronological order under each subject.

To economise space the following abbreviations of titles have been employed:—

Annl. Rept. R.B.G.	...*Annual Report, Royal Botanic Gardens, Trinidad.*
Annl. Rept. D.A.	...*Annual Report, Department of Agriculture, Trinidad and Tobago.*
B.B.D. ...	...*Bulletin Botanical Department, Trinidad.*
B.D.A. ...	...*Bulletin Department of Agriculture, Trinidad and Tobago.*
P.A.S. ...	...*Proceedings Agricultural Society, Trinidad and Tobago.*
W.I.B. ...	...*West Indian Bulletin.*

GENERAL.

1.—"Rubbers" J. H. Hart, *Annl. Rept. R.B.G.* 1890, 20.

Rubber planting considered likely to be profitable. "We have several kinds of these plants well established in our Gardens, the most prominent being *Castilloa.* I hear it is doing well in Tobago. *Ficus elastica* probably comes next in its suitability for cultivation and it has been strongly recommended by the Kew authorities during the past year as suitable for extensive culture. Next to these comes *Hevea brasiliensis.* This tree thrives well and produces rubber of excellent quality. *Hevea Sprucei* or Demerara rubber is also represented in our collections. *Manihot Glaziovii* can be readily grown in almost any kind of soil existing in the Island."

2.—"Rubber" J. H. Hart, *Annl. Rept. R.B.G.* 1897, 14-15.

General account of rubber in the Colony with list of kinds growing. "Of these according to our experience, the most suitable for growth in Trinidad is *Castilloa elastica.*" Similar summary in *Annl. Rept.* 1898, 9 to 11.

Annual crops from Castilloa suggested.

3.—"Rubber" J. H. Hart, *B.B.D.* iii., 1897. 22.

Attention directed to rise in price of rubber; planting recommended. Best sources believed to be (1) Castilloa (2) Hevea.

4.—"Rubber at the Royal Botanic Gardens" J. H. Hart *B.B.D.* iii., 1897. 35-39.

First fruiting of Landolphia reported 1896; 10,000 *Castilloa* plants sold during 1896. Rubber Industry recommended.

5.—"India rubber" *B.B.D.* iii. 1899. Extra number.

Reprint of article from "*Spon's* Encyclopœdia" giving general information on rubber to which Hart adds some notes:—Best rubbers for Trinidad and Tobago—*Castilloa, Hevea, Manihot (Ceara) and Kickxia* [now called *Funtumia.*]

Castilloa quickest yielder, fastest grower. R. Cross quoted that will give larger return per acre than any other, and be the most remunerative under cultivation. Best under shade.

Hevea Finer rubber, longer to grow, better for permanent plantation; Trimen quoted, urging cultivation in Ceylon; will grow on lands under water for several weeks and also in fairly dry lands.

6.—"Hay's Handbook of the Island of Tobago" 1899. p. 32.

"A rubber industry may also now be added to future sources of wealth. A syndicate formed for the purpose of planting rubber, has been in active operation for some time past."

7.—"Rubber planting in the West Indies." J. H. Hart, *W.I.B.* ii., 1901, 100-10.

General account of rubber plants in Trinidad and Tobago. *Castilloa* recommended for plains at low elevation; *Hevea* for swampy districts; *Manihot* (Ceara rubber) for poor and dry lands and hill sides; *Funtumia* for poor soil at low levels. *Castilloa* "appears to be one of the best for general cultivation, as it grows fast, gives quick returns and affords a large yield . . . . . . Para rubber takes longer to grow, but may in the end prove more profitable."

Planting, preparation, etc., discussed.

8.—"Extraction and Preparation of Rubber" *W.I.B.* v., 1904, 210-23.

General article on *Hevea, Castilloa* and *Funtumia* with an extract from "Annual Report," Botanical Department, Trinidad, 1902-3.

9.—"A New Rubber Knife" *B.B.D.* vii., 1906-7, 12-13.

The Acme knife (T. Christy & Co.) V cut useful for *Hevea* or *Castilloa.* Demonstrated at Agricultural Conference 1905. Invented by J. H. Hart.

10.—"Shipment of Rubber from Trinidad" *B.B.D.* vii., 1906-7, 203.

Shipment of 1,000 lb. at a time recorded. Castilloa sheet sold for 4/3 and 3/4. Scrap 3/3. Para rubber also prepared from oldest tree in the Gardens.

11.—"Rubber Industry in Trinidad" J. H. Hart *B.B.D.* VII, 1906-7, 255-6.

General progress noted. *Castilloa* seeds obtainable all over the island and rapidly being distributed by birds. *Hevea* seeds in great demand importations made with varying success *Funtumia* seed available from St. Clair.

12.—"Progress of the Rubber Industry in Trinidad" J. H. Hart *W.I.B.* viii., 1907, 195-99.

General account of rubbers tried, methods of tapping, etc. Rubber industry regarded as now well established in Trinidad and to have a prospect of abundant success.

13.—"Rubber" J. H. Hart. *Annl. Rept. R.B.G.* 1907-08, 13.

List of rubber plants at St. Clair. Samples of rubber from various estates reported on in England show "that rubber can be produced in Trinidad of the best quality and that there is evidently a good prospect of remunerative returns from its cultivation."

14.—"Rubber in Trinidad" *B.B.D.* viii, 1908, 48-58.

Imperial Institute report on rubbers from Trinidad. *Hevea*, *Castilloa*, *Funtumia* and *Landolphia*; also Loranthus rubber and Balata from Venezuela.

15.—"Rubber Notes" J. H. Hart, *B.B.D.*, viii., 1908, 86-7.

Much more to be learnt but "so far as the work has gone the sum total appears to be:—Rubber is now a profitable investment and likely to remain so for some time to come. Several classes of rubber can be grown. *Hevea* stands easily first, *Castilloa* second, *Funtumia* will be placed third for the present as less is known about it."

16.—"Report on Trinidad Exhibits. International Rubber Exhibition London 1908." *P.A.S.*, viii., 1908, 437-42.

"Messrs. Lewis & Peat report that the samples show a great improvement on anything which they have so far seen from the West Indies, and they add that there is great promise for the industry in the future."

17.—"Rubber." P. Carmody. *Annl. Rept. D.A.*, 1909-10. 8-9.

Trees reported by planters: *Castilloa* 600,000; *Hevea* 80,000; *Funtumia* 25,000. Importation of *Hevea* seed from Malaya unsuccessful; 3,000 grew out of 15,000, and only one out of second lot of 1,100,000. Notes o H. S. Smith's machine for *Castilloa* and summary of Imperial Institute reports. Resin contents in Trinidad and Tobago *Castilloa* rubbers from trees of varying ages: general indication that 8 years is the minimum age for tapping.

18.—"Rubber cultivation in Trinidad and Tobago" J. B. Carruthers, *B.D.A.*, ix., 1910. 3-9.

A general account of rubber cultivation in the Colony. The section "Hevea or Castilloa" is reproduced on page 100 of this report. Other topics discussed are planting distance, tapping *Castilloa*, future experimental work.

19.—"Analyses of Trinidad and Tobago Rubbers made at the Imperial Institute." *B.D.A.*, ix. 1910, 228-9.

Tabulated analyses of *Castilloa*, *Funtumia africana*, *F. elastica* *Hevea* and Balata.

20.—"Rubber Tapping Experiments" A. E. Collens. *Annl. Rept., D.A.* 1910-11. 65-73.

A summary of experiments, mostly recently started.

Hevea. Method of coagulation and preparation of rubber described. Record of latex obtained at each tapping (alternate days) from six trees at St. Clair given September, 1910, March 1911; also yield of dry rubber. Analyses of Hevea "biscuits" from Longdenville and Non Pareil estates.

Castilloa. Resumé of experiments on methods of tapping and treatment of latex. Excision method, half-herring bone, with a gouge knife, seems promising, the channels filling up rapidly with renewed bark.

13 trees Verdant Vale estate, 8 to 9 years old tapped to height of 6 feet yielded 3 oz. rubber each, November 2, and ¾ oz. on November 17. Old tree R.B.G., to height of 40 feet, gave 3 lb. 3 oz., February 8, and 1 lb. 12 oz. on March 9. Method of creaming *Castilloa* latex and making sheet rubber described. Information also on Funtumia, Manihot, etc.

21.—"Rubber in Trinidad and Tobago" 1911 pp. 1-35. Illustrated.

A pamphlet prepared by the Department of Agriculture for the International Rubber Exhibition, London 1911, containing a general account of rubber in the Colony; a reprint of the paper by Mr. J. B. Carruthers; Crown Land Regulations; rainfall returns (maximum and minimum) from 75 stations from 1900-1910 and monthly details for 1910; list of exhibits sent by the Department to the Exhibition; historical notes on Trinidad and Tobago.

22.—"Rubber Exhibition, London 1911." *B.D.A.* x., 1911, 192-204.

Reports by P. Carmody, Messrs. Lewis & Peat, J. Kelway Bamber.

23.—"Notes on the Preparation of Plantation Rubber" Messrs. Lewis and Peat. *B.D.A.* x., 1911. 205-8.

Methods of preparation, coagulation, grading, sorting, packing, marking and sales in London, described for the guidance of producers and exporters

24.—"Rubber Exhibition, London 1911—Report by Prof. Carmody, Official Delegate" *P.A.S.* xi., 1911, 458-63.

Amongst other matters the good qualities of both *Castilloa* and *Funtumia* rubber prepared by Mr. H. S. Smith's machine are mentioned.

25.—"Rubber Exhibition, London 1911." *B.D.A.* xi., 1912, 200-01.

Judges' report on competition for "India Rubber World" Trophy for improvement in Castilloa tapping.

Also records award of two silver cups to Trinidad and Tobago. (1) Department of Agriculture for best exhibit by a West Indian Botanical Department and (2) Permanent Exhibition Committee for best West Indian comprehensive exhibit.

26.—"Rubber Culture in Tobago" *P.A.S.* xi., 1911, 265-70.

Reprint of a pamphlet prepared by the Tobago Planters' Association for the International Rubber Exhibition, London 1911. 120,000 *Castilloa* reported in the island, mostly with cacao. Yield at 10-12 years. ½ to ¾ lb per year, from 4 or 5 light tappings, to 7 feet. Richmond Estate, 7 acre field, 11 year old rubber and cacao, gave 10¼ oz. rubber per tree and 4½ bags (165 lb.) of cacao in a year (=15 bags per 1,000 trees) *Hevea* trees few in number. As regards labour Castilloa regarded as the more suitable tree.

27.—"Rubber Exhibition, 1911—Report on by Messrs. Lewis & Peat" *P.A.S.* xi., 1911. 361–69.

Hevea: practically all the samples good and compared favourably with those from Malaya and Ceylon. "The smoked biscuits from the Trinidad Botanic Gardens deserved special mention."

Castilloa: "taken all round the exhibits were excellent and the rubber prepared by Mr. H. S. Smith's new machine was as good as any yet produced from this tree. Rubber from Major Walker's Estate 'Easterfield' and Mr. H. S. Smith's Estate 'Caledonia' both Tobago, better than any we have ever seen from Mexico or elsewhere." Detailed reports on rubbers from the various estates.

28.—"Rubber Exhibition, London, 1911—Reports on exhibits sold with prices of rubber from various estates. *P.A.S.* xi., 1911. 521–2.

29.—"Handbook, Trinidad and Tobago." Bd. Agr. 1912 p. 70 T'dad and p. 135 T'bgo.

General reference. Future considered good.

30.—"Rubber in Trinidad and Tobago" A. E. Collens. *B.D.A.* xi., 1912. 88–99.

A paper read at the West Indian Agricultural Conference 1912 giving a historical summary of introduction, etc., the kinds of rubber plants under cultivation, methods of tapping and preparation and reports from England on Trinidad rubber. Tapping experiments in Trinidad and Tobago are summarised.

31.—"Rubber Experiments in Trinidad and Tobago" *W.I.B.* xii., 1912 244–55.

Summary of demonstration at St. Clair Experiment Station to members of Agricultural Conference, of a paper by Mr. A. E. Collens, and of other papers and discussions.

Mr. Collens' paper appears in *W.I.B.* xiii, 1912, 219–35.

32.—"Rubber Experiments, Roxburgh Estate, Tobago" *B.D.A.* xv., 1916. 142.

Records annual girths in manured and unmanured plots of *Hevea*, *Castilloa* and *Funtumia*, 1911 to 1915.

33.—"Rubber Survey of Trinidad and Tobago" *B.D.A.* xv., 1916. 149–154.

Speech by Sir Norman Lamont, Bt., moving appointment of Rubber Committee, Board of Agriculture also Circular letter and Schedule of Questions sent to Estates.

HEVEA.

34.—"Hevea Brasiliensis" H. Prestoe. *Annl. Rept., R.B.G.* 1880, 33.

Two plants, received from Kew 1876, now over 20 feet high.

In his *Annl. Rept., R.B.G.* 1882, 27, he notes that "habit of growth suggests complete suitability as a shade and protection tree for cacao."

35.—"Hevea" *Annl. Rept., R.B.G.* 1894.

Free distribution of seeds made to various planters in the Colony.

36.—"Para Rubber, Hevea Brasiliensis" J. H. Hart, *B.B.D.*, ii., 1895, 18–19.

Oldest tree Royal Botanic Garden, Girth at 4 feet from ground 47 inches. Age not certain, probably not more than 15 years. Recommended as main crop and also as shade for rubber. "If an investor has money at his disposal to plant up a large area and can afford to wait, I feel satisfied that he would be richly repaid by planting *Hevea Brasiliensis.*

37.—"Hevea" J. H. Hart, *Annl. Rept., R.B.G.* 1898, 10.

Slower growth than *Castilloa*, "but grown for a permanent crop it will probably exceed that tree in value."

38.—"Hevea" J. H. Hart, *Annl. Rept., R.B.G.*, 1899, 9.

"Para Rubber—This tree grows well with us but the yield of latex appears from a single experiment to be insufficient to warrant its being largely planted except on swampy or riverside lands subject to floods.

Hevea confusa not being largely sown as the rubber is found to be of inferior character.

39.—"*Hevea confusa*" *B.B.D.*, iii., 1899. Extra No. p. 19.

Tree formerly known as *H. Spruceana—R.B.G.* determined at Kew as *H. confusa*, Hemsl.

40.—"Hevea Brasiliensis--Para Rubber" *B.B.D.*, iii., 1899, Extra No. and iii. 1899, 164.

Large tree in Gardens producing seed for some years; gave 2,500 seeds Nov. '98. Specimens recently determined at Kew. Trees at St. Clair growing well.

41.—"Hevea Brasiliensis" J. H. Hart. *B.B.D.*, v., 1902–03. 420.

Note that from experience in Trinidad the view that it will only grow in muddy situations, on river banks, etc. is untenable.

42.—"Hevea" *B.B.D.*, vi., 1904–05, 212. Report W. Leslie, Agr. Instructor of.

Visit to plantation of Hevea near bank of Ortoire River, Mayaro Ward planted under large Mora, etc. in Virgin Forest, smaller trees and bush cut down. Only few alive, and those very weak. Stated that planted without removing the bamboo pots.

43.—"Hevea" J. H. Hart, *Annl. Rept., R.B.G.*, 1905, 5.

Trees at St. Clair, planted 1898, now beginning to bear. Para rubber selling at 6/6 per lb. "These high prices have induced numerous planters to start Hevea cultivation."

44.—"Hevea" J. H. Hart, *Annl. Rept., R.B.G.* 1906–07, 14–15.

Now extremely popular on account of success in the East: local supply of seed not equal to the demand, and importations made with but little success.

45.—" Eleven years ago, (Hevea brasiliensis) *B.B.D.*, vii., 1906–07, 87–9.

Reprint of an article from Bull. Jan. 1895 advocating planting of *H. brasiliensis* in Trinidad.

Notes that largest tree " whose age we are unable to ascertain " has diameter at ground of 22 inches, diameter at 4 feet from ground of 15 inches; tree about 40 feet high.

46.—" Hevea Seed " *B.B.D.*, vii., 1906–07. 188–90.

Reprint from " Kew Bull." 1906 on success in sending seeds from Singapore. Trinidad experiences recorded. 2 per cent. raised from Ceylon seeds. Sterilised material, charcoal, coconut fibre waste, etc., " tobacco damp " recommended.

47.—" Seminal Variation in Hevea brasiliensis " *B.B.D.*, vii, 1906–07. 204.

Two trees in Royal Botanic Gardens, both determined as *H. brasiliensis*. One yields rubber with yellow tinge, the other of a white or transparent appearance. Rubbers differ also in tensile strength (no particulars given.)

Young trees in Trinidad differ very considerably in leaf characters ascribed to seminal variation. Records of quality and yield should be on averages of whole fields not of individual trees.

48.—" Para Rubber—Hevea brasiliensis." *B.B.D.*, vii., 1906–07. 207.

Old tree in Royal Botanic Gardens recently tapped and specimen sent to Imperial Institute for report. Crop of seeds harvested over 4,000. Germination 98 per cent.

49.—" Hevea and Castilloa " J. H. Hart. *B.B.D.*, viii., 1908. 6.

Records that Castilloa outgrown by Hevea in plot at St. Clair planted in 1898.

50.—" Seminal Variation in Hevea brasiliensis " *B.B.D.*, viii. 1908. 8–10.

Summary and discussion of article in *Journal d'Agriculture Tropicale* July 1907, advocating selection from best producing trees, occurrence noted in Trinidad of trees yielding yellow and white latex, producing rubbers of different quality.

51.—" The Seed Time and Harvest of Hevea " J. H. Hart. *B.B.D.* viii. 1908. 27–8.

Seed time, Trinidad, October, November. Flowering February to April or May (with the new growth). Latex reported most as abundant in December and January and that does not run as freely in the wet as in the dry season.

52.—" Hevea from Venezuela " J. H. Hart. *B.B.D.*, viii., 1908. 102–03.

Notes on *H. Benthamiana* and other species under cultivation in Royal Botanic Gardens, and St. Clair.

53.—" Local Grown Para Trees. Quality of Latex " T. L. Orde *B.D.A.*, ix., 1910, 230–31.

Making enquiries regarding Hevea—particularly as to whether in Trinidad and Tobago it grows as well, and produces rubber in quantity and quality equal to the East.

54.—"Hevea -the Cultivation of in the Malay Peninsula" P. J. S. Cramer. *P.A.S.*, xi., 1911. 3–130.

A general account of the cultivation and preparation of Para Rubber, with 40 plates and other illustrations.

55.—"Hevea--Rio Negro" Report on suggested information of, *P.A.S.*, xi, 464-7.

56.—"Hevea--Rubber Returns." A. E. Collens, *B.D.A.* xii.. 1913. 75–76.

Tapping results from trees in Botanic Gardens and St. Clair Experiment Station, 1910–12. The oldest tree (about 40 years) gave 22 lb. 13 oz. tapped on alternate days for six months in 1912.

57.—"Notes on the cultivation of Para Rubber" F. Evans *W.I.B.* xiii., 1913. 259-63.

General account of Eastern methods in comparison with those practised in Trinidad. Clean weeding not advocated because of cost; figures given to show that trees in well drained land in Trinidad compare well in growth with average trees on clean-weeded lands in Federated Malay States. Cover crops recommended for Trinidad. Tapping, etc. described. Eastern "tasks" detailed. Estimate given of cost of one acre of *Hevea* in Trinidad for first five years and of subsequent upkeep, tapping, etc.

58.—"Para Rubber Seeds" *B.D.A.*, xiii, 1914, 292 and 293.

Summary of Imperial Institute report on properties and uses of the oil which may be regarded as an inferior linseed oil. The oil cake has been fed without harm to cows and sheep. Analysis given.

59.—"Para Rubber in British Guiana," C. K. Bancroft. *Journ. Bd. Agr. Br. Guiana*, viii, 1915, 73-4.

Cost per acre to bring area 500 acres into bearing under £40.

				Per Tree.	
Expt. Tapping.	*No. Trees.*	*Age yrs.*	*Yield.*	*Per annum.*	*Cost.*
	379	5½ Nov. 1913 to Dec. 1914	597 lb.	1½ lb.	16c.
	300	6½ Feb. 1915 to May, 1915	240 lb.	2½ lb.	7c.

300 lb. per acre to be counted on for large areas in full bearing, = return of $144.00 per year.

Collecting (15c. per lb.), management, upkeep, curing, shipping, etc., = $45 per acre. Total $90.00 therefore profit $54.00 per acre.

Estates should be in blocks of 50 acres, each in charge of a driver. Labourers houses and coagulating houses scattered in convenient places. Factory central for rolling, curing, etc. One man collect latex in half day from 300 trees, 2 cuts to each. Tapping force one man to three acres. Permanent labour could have lands on rent near by. He considers, provided sufficient labour available, the cultivation of rubber should prove successful.

60.—" Hevea Rubber, Cultivation and Curing at Non Pareil Estate, Sangre Grande, Trinidad," E. A. Robinson, *B.D.A.*, xvi, 1915. 118–19.

Results of tapping 1,200 trees, 6 to 9 years old, in 1914–15.

Yield 1,608 lb. at cost of 13.7 cents per lb.

Estimate given of expenditure and revenue on rubber cultivation (in bearing) indicating a profit of $60.86 per acre (£12 13 7.)

61.—" Notes on the Tapping of Para Rubber" W. G. Freeman, *B.D.A.*, xv, 1916. 155–62.

Modern methods of tapping in the East are described, and yields per acre given.

The experiments in tapping intervals in the Botanic Gardens Trinidad are described and results summarised for 1911–1916. (*See* extracts on p. 112).

CASTILLOA.

62.—" Castilloa elastica " H. Prestoe. *Annl. Rept. R.B.G.* 1882. 30.

The three introduced trees have done well so far, bearing out reputation as giant forest trees; except for planting as components of forest growth their culture cannot be thought of economically.

63.—" Castilloa elastica " H. Prestoe. *Notes on economic and other plants for distribution at the Botanic Gardens, St. Ann's.* 1885. 1.

Regarded of as permanent use as cacao shade and bearing promise of yielding an auxiliary crop. Value as shade will depend on whether a deep rooter, which can easily be tested. Recommended for trial on cacao and sugar estates, where soil is moderately good and easily penetrable to a good depth.

64.—" Castilloa " J. H. Hart, *Annl. Rept. R.B.G.* 1887. 22.

Recommended for trial as likely to be of economic value. Whether will be a good shade for cacao has yet to be determined.

65.—" Castilloa—Central American Rubber " J. H. Hart., *B.B.D.*, i. 1888 No. 4.

Attention directed to rubber as plants for cultivation, product increasing in demand and price. *Castilloa* recommended as one of the most promising. Requires moist climate, equable temperature, sheltered position soil—warm loam or sandy clay. The trees in Bot. Gardens then 25 feet high. Date introduction unknown. Has this year produced seeds. Experiments with it suggested possibility of growing with cacao as a shade. Directions given for treatment of seedlings and their planting 50 plants available at Gardens offered "in pairs only, at the low rate of $1.00 per pair."

66.—Revised Edition of above. *B.B.D.*, i. 1894. 282–4. Recommends cultivation by itself, rather than with cacao, etc. Protection from wind necessary. Yield estimated at 1 lb. per tree planted 13 feet by 13 feet.

67.—"Castilloa—Report on the Agri.-Horticultural Resources of Tobago", J. H. Hart, *B.B.D.*, i. 1889, No. 12 p. 11.

"The rubber tree recommended for cultivation is that known as *Castilloa elastica*" in shady ravines, and well sheltered lands, with soil of a moist character not liable to extreme drought. *Spon's Encyclopædia* quoted—Tree 18 inches in diameter (prob. 6 or 8 years old) yields in Nicaragua 20 gallons milk giving 50 lb. rubber—this a maximum figure and the average is somewhat less."

With rubber at 2/- this indicates extremely valuable return "even if the figures given were divided by 20."

From similarity of climate in Central America and Tobago it is considered that Castilloa is likely to become naturalised in a very short time and to thrive equally as well as any indigenous plant.

68.—"Castilloa" J. H. Hart, *Annl. Rept. R.B.G.* 1889. 20.

Seeds produced in fairly large quantities; demand for plants "full and constant." "This is undoubtedly a tree suitable for cultivation and as it yields rubber freely all the year round, it is probably one of the most valuable of our rubber producing plants." Advice given to avoid planting it in the open.

69.—"Report on Cacao in Venezuela" J. H. Hart. *B.B.D.*, i., 1893, No. 19.

Castilloa elastica common wayside tree in Nicaragua; always under shade of other trees. Being planted extensively for rubber, "but always with the protecting shade of large trees, and in areas proved to be unsuited to the growth of cacao by actual experiment."

70.—"Castilloa—Central American Rubber" J. H. Hart, *B.B.D.*, i., 1894 No. 23, 282-7.

Revised edition of article in Vol. 1, No. 4, (1888).

Does not regard it so good for cacao shade as Erythrina and Gliricidia, "still it may sometimes with advantage be planted conjointly with crops such as cacao and nutmegs" but later by itself shaded by Saman.

13 x 13 (257 to acre) with annual yield of 1 lb. rubber gross return £25 per acre. Rubber 2/- per lb., but "estimated that when fairly established the yield per tree per annum would be three or four times the quantity mentioned." Insists should only be planted in well protected situations. Its cultivation "probably only needs proper attention to place it in the first rank of our West Indian Industries."

Noted that actual returns yet await to be known.

71.—"Castilloa" J. H. Hart, *Annl. Rept.*, *R.B.G.*, 1898. 5.

Report sales by public auction at the Garden, seeds 30/- per 1,000; one year plants 3½d. each; boxes of seedlings 4/- per 100.

72.—"Castilloa" *Annl. Rept. R.B.G.*, 1899. p. 9, 10.

Importance of shade insisted on. "Castilloa under favourable conditions in Trinidad makes rapid growth and is probably better suited to the climate than any other class of rubber as it comes to maturity earlier and can be handled with a minimum of previous planting experience." Specimens of rubber sent to England prove that our Castilloa trees are the best kind in cultivation. The large crops of seed now available will make it possible to grow stems for extracting rubber from in their young state. One year old stems contain 8 per cent. of dry rubber.

73.—" Castilloa " J. H. Hart. *Annl. Rept.*, *R.B.G.*, 1899. 9.

Thrives well, and has proved very hardy under trying conditions. Machine imported from England to prepare rubber by a creaming process. " *Castilloa* promises the best of any of the rubbers, so far, for local cultivation."

74.—" Castilloa—Notes on coagulation of the latex of *C. elastica* " J. H. Hart, *B.B.D.*, iii., 1899, Extra No. No. 19–22 ; also iii., 1899, 165–6.

Discusses Biffen's centrifugal method. Use of juice of *Ipomea. bona-nox.*

75.—" Castilloa "—*W.I.B.*, i., 1900, 153.

Establishment of a regular plantation of rubber trees, the first in the West Indies, by Mr. Esme Howard in Tobago recorded isolated groups also being planted in Trinidad, etc.

76.—" Castilloa "—(Rubber in Tobago) M. Short. *W.I.B.*, ii., 1901, 110-11.

Reprint of letter in *Tropical Agriculturist.* Cultivated rubber in Tobago, particularly *Castilloa,* likely to prove successful. 21 lb. sample from trees 8 to 9 years old recently valued by Messrs. Lewis and Peat at 3/6d. Louis d'Or Estate reported to have 160 acres *Castilloa* and 40 of Ceâra (*Manihot*).

Cacao bears very well under *Castilloa,* as also does coffee.

77.—" Castilloa " J. H. Hart, *Annl. Rept.*, *R.B.G.* 1901-02. 6.

Earlier suggestion that rubber obtainable from one year old trees found to be illusory, only trees 8 to 10 years old yield rubber of good quality. [*See* 72.]

78.—" Castilloa"—D. Morris *W.I.B.*, iii. 1902, 10.

" The best tree to cultivate in the West Indies is undoubtedly the Central American Rubber (*Castilloa elastica*). There is a possible opening for rubber planting, either separately or with cacao at Trinidad, Tobago Demerara, and Jamaica. The plantations already started at Trinidad and Tobago will show to what extent cultivated tree are as productive as those in a wild state, and whether the industry offers a suitable return on capital."

79.—" Castilloa—Coagulation of Rubber" J. H. Hart. *B.B.D.*, v., 1902–03. 557–8.

Dr. Weber adversely criticises Hart's estimate of 2 to 6 lb. per annum from *Castilloa* trees, which Hart justifies on basis of 14 oz. from one tapping and multiplies this by 3, 4, or 5—the number of tappings to be done in a year.

Funtumia at St. Clair 30 feet high at 4½ years. " At present everything appears to favour the belief that in *Funtumia* we have a much more profitable tree than we have in *Castilloa* and one much more easily grown and worked."

80.—"Report on the Seed of *Castilloa elastica*" *B.B.D.*, v., 1902-03. 629-30.

Imperial Institute Report, including chemical analysis. The oil yields soap of fair quality.

81.—"Castilloa—Report on samples of Castilloa and Funtumia Rubber from Trinidad" *B.B.D.*, vi. 1904. 29-35.

Imperial Institute Report dated 10.11.03. Young (4 year) trees very inferior, resin very high, valueless.

Analyses given in detail. Latex washed and creamed. Valued 2/4 to 2/9 per lb.

82.—"Castilloa—Rubber Preparation and Castilloa Rubber" J. H. Hart. *B.B.D.* vi. 1904-05. 162-164.

Refers to article in *India Rubber World* October 1, 1900, criticising Biffen and Parkin's work (*Annals of Botany*) on "Latex and its Functions." They regarded coagulation of Rubber as due to coagulation of albuminoids in the latex. Hart argues that coagulation ensued as easily when the albuminoids had been removed.

Parkin *India Rubber World* January 1901 supports original view, *i.e.* cogaulation of the albuminoids.

Weber's article *India Rubber Journal*, August, 1904, summarised, method of tapping described. Vertical V horizontal tapping cuts touched upon. Also Weber's tapping tool. Hart refers to one he had devised. Variation in density latex with variation in rainfall referred to. Suggests moderately thick latex more economical to treat. Creaming method of preparation described. Weber advocates partial shade for *Castilloa*—growing up amongst other trees. Hart regards Castilloa thus "given a continuance of the prices of to-day, a good return to those investing in the cultivation can be confidently expected"—but much to be learnt yet—methods, etc.

83.—"Castilloa" W. Leslie, *B.B.D.*, vi., 1904-05. 212.

Records visit to two planted areas—about ten acres each, in Mayaro ward. (1) in forest mostly felled and traces cleared through the under-brush. (2) in ordinary estate manner. Trees in (2) stronger and healthier; as tall but not so spindly.

20,000 trees at Monte Cristo (Cumuto) 1-8 years old, under forest shade. Some tapped 1903. Rubber very inferior and small in amount.

84.—"Castilloa Rubber in Tobago" M. Short *W. I. B.*, vi. 1906. 139-49.

Paper contributed to Agricultural Conference, giving general account *Castilloa* in Tobago. Describes tapping methods, yields, etc.: three quarter to 1 lb. per tree may safely be reckoned on from 13 to 14 year old trees. Cost of collection 8d. to 9d. per lb. *Castilloa* employed as a shade for cacao gave £4 to £6 more per acre than cacao of same age with Bois Immortel. List of points on which further information is required.

Paper followed by discussion by Mr. Hart, Sir D. Morris, and others. Evidence quoted from Venezuela that *Castilloa* and Cacao thrive together.

Reprinted in Col. Repts. Misc. 36, *Report on the working of the Imp. Dept. Agr. for the West Indies,*" *London, 180-189.*

85.—" Castilloa " J. H. Hart. *Annl. Rept., R.B.G.*, 1906-07, 15.

1906 first year in which exported in marketable quantities Castilloa now well established in Trinidad and being rapidly distributed naturally, by birds and bats. Planters inclining to view that preparation of " scrap " rubber is the more profitable; similar advice from a grower in Nicaragua. Seed still in demand. Department has orders for 50,000, and ten times that number will probably be sold this season by private growers.

86.—" *Castilloa elastica* " *B. B. D.*, vii. 1906-07, 78.

Trees in Naparima 6½ years old, 25–30 ft. high and 20–37 in. in girth without shade but rather closely planted. Suggested might have been larger had they had suitable shade.

87.—" Suitability of Castilloa for a moist climate " *B. B. D.*, vii, 1906–07. 127–8.

Arden (*Ag. Bulln. Straits*) gives *Castilloa* as an example of a plant unsuited " to the hot moist conditions obtaining in the Malay peninsular " Hart states not so in Trinidad where it requires abundant moisture and does not thrive in dry situations.

Hevea, which Arden mentions as standing moisture well, will in Trinidad stand drought for long seasons.

88.—" Reports on Castilloa Rubber from Tobago " *B. D. A.*, ix. 1909, 23–24.

Imp. Institute report on sheet *Castilloa* from Richmond Estate. Value 4/2d. with Para at 5/-.

89.—*B.D.A.* ix, 1910, 41–3. Imp. Institute reports on *Castilloa* rubber prepared in Smith's Centrifugal Machine. Values 6/4d. to 6/11d. with fine hard Para at 8/4. The trees were all rather young, 7–8 years.

90.—*B. D. A.*, ix 1910, 217–9. Imp. Institute report. Rubber from trees in Panama showed fall in resin contents from 42·33% in two year old trees, to 7·21% in 8 year old trees. Trinidad results higher for corresponding ages. Figures given from various estates.

91.—*B.D.A.*, ix. 1910. 223-5. Imp. Institute Report on Rubber prepared by Smith's Machine.

92.—*B.D.A.*, ix. 1910. 225.

Analyses showing resins ranging from 53·99% in 3 year old tree to 11·37% in 15 year old tree.

93.—" Castilloa—Smith's Patent Centrifugal Machine."

Specification: *B.D.A.*, ix. 1910. 219-21. Complete specification, illustrated, of machine invented by Mr. H. S. Smith of Tobago, for Castilloa rubber.

94.—Preparation of Rubber. P. Carmody. *B.D.A.*, ix. 1910, 222.

An account of the above machine and method of preparing sheet Castilloa by it.

95.—"Tapping Castilloa Trees" *B.D.A.*, ix. 1910. 226-7.

Illustrated account of method of tapping with horizontal chisel cuts in vertical rows, and collecting "aprons" around foot of tree.

96.—"Cacao and Castilloa Rubber Experiments" J. de Verteuil, Annl. *Rept., D. A.* 1910–11, 62–63.

Details of proposed manurial experiments on various estates in Tobago.

97.—"The Castilloa Industry in Mexico and Central America" H. S. Smith, *B. D. A.*, x. 1911, 81-93.

A report on visit to Mexico and Central America on behalf Bd. of Agriculture.

(*a*.) The variety of *Castilloa* in Trinidad and Tobago is the same as that cultivated in Mexico, where it has been proved that its culture can be made a commercial success.

(*b*.) General climatic and economic conditions are equally favourable in this Colony.

(*c*.) Nothing to justify statements that 10-12 year old *Castilloa* yield in Mexico an average of about 2 lb. per year : the average is nearer half-pound per tree.

(*d*.) Our yield can be increased by higher tapping, and cost reduced by adopting some modification of Mexican methods.

(*e*.) Percentage of resin in trees of similar age is probably the same in both places, but resin in Mexican rubber as exported is lower owing to the number of large wild trees tapped, their latex being mixed with that of the young cultivated trees.

98.—"Castilloa tree. Results of tapping" A. E. Collens. *B. D. A.*, x. 1911, 93–4.

Tree in Royal Botanic Gardens, about 30 years old, tapped to height of 40 ft. gave 3 lb. 3 oz. at one tapping.

99.—"Castilloa—Illustrations of Tapping" *P. A. S.* xi. 1911. 321 & 405 (Plates).

100.—"Castilloa—The Cost of Tapping Rubber" M. Short. *B. D. A.* xi. 1912, 197–9.

The comparative cost of tapping *Castilloa* and *Hevea* is discussed and necessity for fuller exact data indicated.

Cost of *Castilloa* sheet rubber on Capt. Short's Estate (Richmond, Tobago) was 9d. per lb.; with increase in wages it has risen to 10d. or 11d. Light and continuous tappings recommended.

101.—"Castilloa elastica or Central American Rubber Seeds" *B. D. A.*, xiii. 1914, 293.

Summary of Imp. Institute Report on the seeds as a source of oil. Analysis given also of Para seed oil. The oil cake is bitter and the oil is not a drying oil as *Hevea* seed oil.

102.—"Castilloa—Cacao and Rubber Experiments" *B. D. A.*, xiv. 1915, 95–6 and xv. 1916, 140–1.

Yields of cacao in manured plots interplanted with *Castilloa* at Richmond Estate, Tobago.

FUNTUMIA.

103.—"Funtumia elastica" *B.B.D*, iii, 1899, 181.

Plants at St. Clair put out 11 months ago (*i.e.* August, 1898) flowered June 1899 when five feet high. Probably premature induced by exceptionally dry season. In this note referred to *Kickxia Africana* noted that Preuss refers it to *K. elastica.*

104.—"*Kickxia elastica.* Funtumia Elastica," *B.B.D.* iii. 1899 Extra Number, also iii 1899, 164.

Plants at St. Clair, from Kew seed about 5 feet high. Flowered in May, 1899.

105.—"Funtumia Africana" J. H. Hart, *B.B.D.* v 1902–3. 505.

Notes occurrence at St. Clair of *F. elastica* the true West African rubber tree and the worthless *F. africana.*

106.—" Report on samples of Castilloa and Funtumia Rubber from Trinidad" *B.B.D.* vi. 1904, 29-35.

Imperial Institute Report 10/11/03.

F. africana and *F. elastica* both sent.

	Moisture.	*Caoutchouc.*	*Resin.*	*Dirt.*
F. africana	20·7	39·3	60·0	0·7
F. elastica	15·1	80·4	15·3	4·3

inferiority *F. africana* well indicated; plants same age Value 2/2, 2/6 per lb. Castilloa sent at same time 2/4–2/9.

107.—"Funtumia elastica" *B.B.D.* vi. 1904, 110.

Good crop of seed again produced, sold readily. Trees now 6 years old 30 feet in height rubber of good quality has been extracted from them *see* report vi., 1904, 29-35.

108.—" Funtumia elastica" Leslie *B.B.D.* vi. 1904-05, 212.

Cocoloco—4 acres cleared for *Funtumia* and another lot growing well under natural shade of forest.

St. Marie—Large number seedlings being raised. Several acres already in *Funtumia,* 12 x 12, in traces 4 feet wide in forest land cleared of the large trees.

109.—"Notes on Funtumia elastica" F. de Valda *B.D.A.* ix., 1909. 18-20.

Reprint of article from "Tropical Life" iv., 1908. General account of cultivation, etc. comparing it favourably with *Hevea brasiliensis.* Preparation described: (1) Burying latex, (2) Boiling, (3) Thin layers latex on boards, (4) use of *Bauhinia reticulata* Juice.

110.—"Funtumia Coagulation" A. E. Collens. *Minutes Board of Agriculture* November, 1912.

Preparation of biscuits by use of lysol.

MISCELLANEOUS.

111.—" Manihot Glaziovii" H. Prestoe. *Annl. Rept. R.B.G.* 1880. 33.

Three plants, now trees 25 feet high, with large heads and fruiting. Foliage however not perfectly healthy.

112.—" Manihot Glaziovii" H. Prestoe. *Annl. Rept., R.B.G.* 1883. 4. (published 1885.)

Death of two of the trees reported, also poor vitality of seedlings. In a list of plants for cultivation published July 1883, the vigorous nature of Manihot plants is noted, and their cultivation as rubber plants seriously considered and plants offered for sale at 15 cents each or 10 cents in lots of over 50.

113.—" Manihot Glaziovii" *B.B.D.*, vi, 1904-05. 212. Report Agr. Instructor. Several trees Ceara rubber growing well at Chaguaramas and Gasparee.

114.—" Landolphia sp." H. Prestoe, *Annl. Rept. R.B.G.*, 1882. 30.

Received from Kew 1880; growing but not strongly, the soil apparently being unfavourable. Recommended for moist lands, successful cultivation as a rubber plant regarded as improbable.

115.—" Landolphia" *B.B.D.*, vi., 1904-05. 212. Report Agricultural Instructor Leslie.

Reports on Estate near the Ortoire some Landolphias doing well under Forest shade, climbing trunks of large trees.

116.—" Ficus elastica" H. Prestoe. *Annl. Rept. R.B.G.*, 1883, 2. Planted out 1875; diameter now over 1 foot.

117.—" Ficus Vogelii" *Annl. Rept. R.B.G.*, 1888. 10. Plant from Kew, growing freely reported.

118.—" Rubber from Bird Vine (*Loranthaceae*)" *B.B.D.*, vii., 1906-07. 65.

Records that specimens of fruit of a " Loranth" had been received from Venezuelan Correspondent, which, produced an appreciable amount of rubber material. (*See* " Journal d'Agriculture Tropicale Feb. 1906.") Not regarded as of commercial importance.

119.—" A New Rubber Producing Plant " *B.B.D.*, viii. 1908. 70.

Odontadenia speciosa yield small quantity of rubber, valued as equal to good Castilloa. That the plant will become of economic value is improbable, except in areas where wild.

120.—" Alstonia Scholaris " H. Prestoe. *Annl. Rept., R.B.G.* 1882. 31.

Planted out 1868, plant received from Martinique 1867, now over 40 feet high.

USEFUL BOOKS ON RUBBER.

The following and many other books and papers on rubber can be consulted at the Head Office of the Department, St. Clair Experiment Station.

Rubber. P. Schidrowitz. Methuen & Co., London, 1911.

Rubber—its sources, Cultivation and Preparation H. Brown, John Murray, London. 1914. 6s. 0d.

Rubber and Rubber planting. R. H. Lock. University Press, Cambridge, 1913. 5s. 0d.

The Rubber Tree Book. W. F. de Bois Maclaren. Maclaren & Sons, London. 10s. 6d.

Hevea brasiliensis, Para Rubber. H. Wright. Fourth Edition, Maclaren and Sons, London. 15s. 0d.

The Physiology and Diseases of Hevea brasiliensis T. Petch. Dulau & Co., London. 1911. 7s. 6d.

The African Rubber Industry—Funtumia elastica C. Christy. John Bale Sons and Danielsson, London. 1911.

SUGAR.

SUGAR CANE EXPERIMENTS 1915-17.

By Joseph de Verteuil, F.C.S.,
Superintendent of Field Experiments.

RESULTS OF TESTS OF VARIETIES.

The canes under report were grown at St. Augustine and consist of plant canes, first and second ratoons. The plant canes received an application of pen manure at the rate of about 15 tons per acre. No manures were applied to ratoons and all the canes received ordinary estate cultivation.

The season under review was favourable and generally a high tonnage of canes was obtained per acre. The quality of the juice was likewise above the average.

The results obtained from the plant canes are recorded in Tables I and II; those for the ratoons in Tables III to VII; the average results for plants and ratoons in Tables VIII and IX. Table X gives the results of recently introduced varieties.

Information with regard to the date of planting, and testing of the juice is given at the head of the tables.

TABLE I.—PLANT CANES.—FIELD 1, ST. AUGUSTINE ESTATE.

Date planted ... ... September, 1915.
Date reaped and tested ... ... March, 1917 ... ... 17–18 months old.
Rainfall ... ... September, 1915 to March, 1917 ... 73·90 inches.

Cane.	Area under cultivation.	Juice.								Per Acre.		
		Per cent. extracted.	Specific gravity.	Brix.	Percentage of			Qoutient of purity.	Sucrose per gallon.	Canes.	Juice.	Sucrose in Juice.
					Sucrose.	Glucose.	Non-Sugar.					
	Sq. Ft.								Lb.	Tons.	Gals.	Tons.
B. 156	11,000	65·5	1·0757	18·3	14·77	1·81	1·72	80·7	1·589	52·27	7,130	5·06
H. 227	3,280	62·3	1·0722	17·5	14·77	1·36	1·37	84·4	1·584	50·30	6,547	4·63
D. 145	11,500	65·2	1·0700	17·0	14·65	1·48	0·87	86·2	1·567	48·39	6,605	4·62
B. 3390	5,566	64·7	1·0717	17·4	14·29	1·69	1·42	82·1	1·531	46·76	6,323	4·32
B. 208	5,390	61·7	1·0753	18·2	15·84	1·53	0·83	87·0	1·703	44·04	5,660	4·30
B. 6308	5,796	65·4	1·0596	14·6	11·11	2·13	1·36	76·1	1·177	57·02	7,883	4·14
B. 6835	5,880	63·7	1·0770	18·6	16·83	0·74	1·03	90·5	1·812	38·06	5,042	4·08
B. 3922	4,950	64·3	1·0717	17·4	14·78	1·75	0·87	84·9	1·584	42·90	5,765	4·08
D. 504	5,588	65·9	1·0713	17·3	14·73	1·69	0·88	85·1	1·578	42·00	5,787	4·08
B. 147	4,232	63·8	1·0656	16·0	12·71	2·13	1·16	79·4	1·354	50·18	6,730	4·07
Badilla	11,000	64·3	1·0748	18·1	15·47	1·43	1·20	85·5	1·663	40·54	5,433	4·03
D. 109	5,500	67·3	1·0626	15·3	11·82	2·45	1·03	77·2	1·256	49·90	7,079	3·97
B. 6450	5,390	69·5	1·0578	14·2	10·64	1·96	1·60	74·9	1·125	53·64	7,894	3·96
T. 75	3,927	62·7	1·0587	14·4	10·68	2·45	1·27	74·2	1·131	58·65	7,780	3·93
H. 146	4,416	61·4	1·0674	16·4	13·32	1·96	1·12	81·2	1·422	46·98	6,053	3·84
H. ?	4,136	64·7	1·0583	14·3	10·83	2·33	1·14	75·7	1·146	53·84	7,373	3·77
D. 366	10,500	70·8	1·0669	16·3	13·13	2·04	1·13	80·5	1·401	40·24	5,981	3·74
D. 116	10,500	66·4	1·0678	16·5	12·83	2·23	1·44	77·7	1·370	42·73	5,952	3·64
D. 115	5,250	61·6	1·0761	18·4	15·78	1·53	1·09	85·8	1·698	36·82	4,721	3·58
B. 347	5,124	65·6	1·0643	15·7	11·65	2·45	1·60	74·2	1·240	46·65	6,441	3·56
B. 3412	5,544	62·9	1·0613	15·0	9·82	2·88	2·30	65·5	1·042	56·96	7,562	3·52
T. 39	4,048	66·5	1·0647	15·8	12·67	1·96	1·17	80·2	1·349	41·29	5,777	3·48
B. 7169	5,566	66·1	1·0613	15·0	10·65	2·33	2·02	71·0	1·130	47·84	6,674	3·37

TABLE I.—PLANT CANES.—FIELD 1, ST. AUGUSTINE ESTATE.—*Continued.*

Cane.	Area under cultivation.	Juice.								Per Acre.		
		Per cent. extracted.	Specific gravity.	Brix.	Percentage of			Quotient of purity.	Sucrose per gallon.	Canes.	Juice.	Sucrose in juice.
					Sucrose.	Glucose	Non-Sugar.					
	Sq. ft.								Lb.	Tons.	Gals.	Tons.
B. 1753	11,385	62·1	1·0617	15·1	11·43	2·23	1·44	75·7	1·213	46·58	6,103	3·30
B. 16832	5,984	67·5	1·0583	14·3	9·99	2·72	1·59	69·9	1·057	48·86	6,981	3·29
Bourbon	**10,978**	**64·5**	**1·0678**	**16·5**	**13·32**	**1·96**	**1·22**	**80·7**	**1·422**	**37·84**	**5,120**	**3·25**
D. 3956	5,166	65·4	1·0617	15·1	10·30	3·06	1·74	68·2	1·093	48·06	6,631	3·23
H. 27	3,990	63·8	1·0621	15·2	11·62	2·33	1·25	76·4	1·234	42·71	5,747	3·17
D. 2468	12,000	66·7	1·0691	16·8	12·77	2·04	1·99	76·0	1·365	37·16	5,193	3·16
B. 4934	5,390	59·9	1·0678	16·5	14·54	1·29	0·67	88·1	1·552	36·06	4,531	3·14
B. 4578	5,390	68·4	1·0600	14·7	10·42	2·45	1·83	70·9	1·104	42·02	6,064	2·99
B. 376	5,271	66·0	1·0540	13·3	9·49	2·33	1·48	71·3	1·000	44·21	6,201	2·77
T. 202	3,927	65·1	1·0531	13·1	8·95	2·33	1·82	68·4	0·942	41·60	5,760	2·42
B. 6388	5,544	69·9	1·0574	14·1	10·84	2·23	1·03	76·9	1·146	30·45	4,509	2·31

The results recorded in Table I show that a high yield of canes was obtained, eight varieties giving over 50 tons per acre. Although the canes were 17 to 18 months old when reaped in March, the quality of the juice was comparatively poor as the canes had not reached maturity. This confirms the results obtained in the previous year and it is further borne out by the results recorded in Table II, where it will be seen that there has been a great improvement in the quality of the juice, for the same varieties, when tested in April compared with the test made in March. Under normal conditions, therefore, canes at St. Augustine do not appear to be ripe before April. The highest results were obtained from B. 156; twenty-five varieties have done better than the Bourbon and eight have given lower results.

In Field 2, nine varieties were planted of which five are on plots exceeding one acre. The juice from these varieties was tested on March 15 and April 11 respectively and from the figures recorded in Table II it will be seen that none of the varieties were apparently ripe in March as there was a great improvement in the quality of the juice when the canes were tested a month later. The best results were again obtained from B. 156.

TABLE II.—PLANT CANES—FIELD 2, ST. AUGUSTINE ESTATE.

Date planted ... ... October, 1915.
Date reaped and tested ... ... (a) March 15, 1917 .. .. 17 months old.
(b) April 11, 1917 ... ... 18 months old.
Rainfall ... ... October, 1915 to March, 1917... ... 68·87 inches.

Cane.		Area under cultivation.	Juice.								Per Acre.		
			Per cent. extracted.	Specific gravity.	Brix.	Percentage of			Quotient of purity.	Sucrose per gallon.	Canes.	Juice.	Sucrose in juice.
						Sucrose.	Glucose.	Non-sugar.					
		Sq. ft.								Lb.	Tons.	Gals.	Tons.
B. 156	(a)	52,503	66·6	1·0726	17·6	14·81	1·69	1·10	84·1	1·588	43·03	5,848	4·91
	(b)		65·7	1·0828	19·9	17·37	1·47	1·06	87·3	1·881			
D. 145	(a)	56,573	64·3	1·0647	15·8	13·31	1·69	0·80	84·2	1·417	46·15	6,108	4·47
	(b)		63·4	1·0730	17·7	15·29	1·47	0·94	86·4	1·641			
D. 2468	(a)	61,864	66·7	1·0753	18·2	15·31	1·81	1·08	84·1	1·646	36·87	4,993	4·43
	(b)		65·7	1·0868	20·8	18·31	1·47	1·02	88·0	1·990			
T. 75	(a)	25,504	66·4	1·0717	17·4	14·39	1·96	1·05	82·7	1·542	40·74	5,579	4·27
	(b)		65·9	1·0779	18·8	15·90	1·81	1·09	84·6	1·714			
Badilla	(a)	54,945	62·5	1·0819	19·7	17·38	1·40	0·92	88·2	1·880	34·53	4,288	4·20
	(b)		60·6	1·0932	22·2	20·06	1·09	1·05	90·4	2·193			
D. 504	(a)	41,107	62·4	1·0722	17·5	14·87	1·75	0·88	85·0	1·594	36·50	4,723	3·94
	(b)		62·5	1·0819	19·7	17·28	1·62	0·80	87·7	1·869			
T. 202	(a)	20,706	65·7	1·0748	18·1	15·61	1·53	0·96	86·2	1·678	28·29	3,793	3·53
	(b)		65·1	1·0877	21·0	19·16	1·15	0·69	91·2	2·084			
T. 39	(a)	19,943	68·6	1·0792	19·1	16·70	1·40	1·00	87·4	1·802	26·60	3,738	3·14
	(b)		67·9	1·0824	19·8	17·42	1·34	1·04	88·0	1·885			
D. 3956	(a)	55,759	67·8	1·0665	16·2	12·36	2·45	1·39	76·3	1·318	35·90	5,103	3·07
	(b)		67·9	1·0700	17·0	12·61	2·35	2·04	74·2	1·349			

TABLE III.—FIRST RATOONS—FIELDS 3 AND 6, ST. AUGUSTINE ESTATE.

Date planted ... ... October, 1914.
Plants reaped and tested ... ... April, 1916 ... ... 18 months old.
Ratoons reaped and tested ... ... April, 1917 ... ... 12 months old.
Rainfall ... ... May, 1916 to April, 1917 ... ... 45·22 inches.

Cane.	Area under cultivation.	Juice.								Per Acre.		
		Per cent. extracted.	Specific gravity.	Brix.	Percentage of			Quotient of purity.	Sucrose per gallon.	Canes.	Juice.	Sucrose in juice.
					Sucrose.	Glucose.	Non-sugar.					
	Sq. Ft.								Lb.	Tons.	Gals.	Tons.
D. 504	37,342	63·3	1·0846	20·3	17·91	1.52	0·87	88·2	1·942	28·08	3,671	3·18
B. 1753	10,080	60·7	1·0797	19·2	16·84	1.52	0·84	87·7	1·818	28·20	3,551	2·88
T. 202	9,812	65·3	1·0923	22·0	20·36	0·85	0·79	92·5	2·224	20·92	2,801	2·78
B. 3859	8,734	62·3	1·0819	19·7	16·95	1·74	1·01	86·0	1·834	26·31	3,394	2·78
B. 4934	10,472	62·3	1·0850	20·4	19·11	0·67	0·62	93·7	2·073	23·09	2,970	2·75
B. 16536	10,318	67·4	1·0801	19·3	16·69	1·81	0·80	86·5	1·803	23·75	3,320	2·67
Badilla	118,645	61·5	1·0964	22·9	20·81	1·02	1·07	90·9	2·282	20·30	2,551	2·60
D. 366	9,922	68·6	1·0801	19·3	16·88	1·34	1·08	87·5	1·823	22·28	3,170	2·58
B. 6835	9,152	61·9	1·0954	22·7	21·16	0·36	1·18	93·2	2·318	19·28	2,440	2·52
B. 208	8,998	65·0	1·0850	20·4	18·43	1·23	0·74	90·3	2·000	20·45	2,744	2·45
B. 6388	11,145	65·7	1·0837	20·1	18·27	1·27	0·56	90·9	1·980	20·18	2,740	2·42
B. 6450	9,042	65·8	1·0837	20·1	18·12	1·17	0·81	90·1	1·964	19·21	2,613	2·29
B. 3390	9,350	66·0	1·0797	19·2	16·65	1·68	0·87	86·7	1·798	19·86	2,719	2·18
D. 115	8,954	63·0	1·0832	20·0	17·02	1·68	1·30	85·1	1·844	19·76	2,574	2·16
T. 75	9,306	65·9	1·0788	19·0	16·13	1·74	1·13	84·9	1·740	20·01	2,738	2·13
B. 156	48,720	64·3	1·0815	19·6	16·14	1·88	1·58	82·3	1·745	20·40	2,717	2·12
B. 7169	9,196	62·1	1·0788	19·0	16·47	1·24	1·29	86·7	1·777	20·55	2,650	2·10
D. 109	8,646	65·7	1·0757	18·3	14·96	2·14	1·20	81·7	1·609	21·10	2,887	2·07
D. 2468	10,010	65·6	1·0810	19·5	16·14	1·99	1·37	82·8	1·745	19·58	2,661	2·07
B. 4578	9,702	66·6	1·0832	20·0	16·61	1·85	1·54	83·0	1·799	18·58	2,559	2·05
B. 3922	9,746	64·8	1·0837	20·1	18·12	1·27	0·71	90·1	1·964	16·93	2,268	1·99

TABLE III.—FIRST RATOONS—FIELDS 3 AND 6 ST. AUGUSTINE ESTATE.—(*Continued.*)

CANE.	Area under cultivation.	JUICE.								PER ACRE.		
		Per cent. extracted.	Specific gravity.	Brix.	Percentage of			Quotient of purity.	Sucrose per gallon.	Canes.	Juice.	Sucrose in juice.
					Sucrose.	Glucose.	Non-Sugar.					
	Sq. Ft.								Lb.	Tons.	Gals.	Tons.
D. 145	27,750	61·1	1·0824	19·8	17·04	1·74	1·02	86·1	1·844	19·17	2,424	1·99
T. 39	10,296	68·1	1·0900	21·5	19·64	0·85	1·01	91·3	2·141	14·91	2,087	1·99
D. 4395	10,252	67·5	1·0775	18·7	14·48	2·42	1·80	77·4	1·560	20·13	2,825	1·97
D. 3956	9,878	63·8	1·0846	20·3	16·59	2·24	1·47	81·7	1·799	18·41	2,426	1·95
B. 6308	4,997	66·3	1·0783	18·9	16·61	1·47	0·82	87·9	1·791	16·89	2,326	1·86
B. 347	10,516	68·8	1·0748	18·1	14·64	1·74	1·72	80·9	1·573	18·17	2,605	1·83
D. 464	10,208	61·5	1·0775	18·7	14·70	2·35	1·65	78·6	1·584	19·79	2,530	1·79
B. 3412	9,086	65·7	1·0726	17·6	13·89	2·24	1·47	78·9	1·490	18·40	2,525	1·68
B. 16832	9,240	68·6	1·0739	17·9	14·79	2·24	0·87	82·6	1·588	16·32	2,335	1·65
D. 4397	9,966	64·0	1·0788	19·0	15·64	2·14	2·12	82·3	1·687	14·15	1,880	1·41
D. 116	17,776	62·6	1·0753	18·2	15·26	1·81	1·13	83·8	1·641	13·75	1,793	1·31
Bourbon	**31,212**	**65·1**	**1·0761**	**18·4**	**15·34**	**1·96**	**1·10**	**83·4**	**1·651**	**10·73**	**1,454**	**1·07**

The highest results were obtained from D. 504 followed by B. 1,753 with 3·18 and 2·88 tons of sugar per acre. The yield from the Bourbon is the lowest of the series namely 10·73 tons of canes or 1·07 tons of sugar per acre,

TABLE IV.—FIRST RATOONS—NURSERY NO. 1, ST. AUGUSTINE ESTATE.

Date planted	August 21, 1914	
Plants reaped and tested	March 28, 1916	19 months old.
Ratoons reaped and tested	March 6, 1917	11 months old.
Rainfall	April 1916 to February 1917	46·31 inches.

CANE.	Area under cultivation.	JUICE.								PER ACRE.		
					Percentage of							
		Per cent. extracted.	Specific gravity.	Brix.	Sucrose.	Glucose.	Non-sugar.	Quotient of purity.	Sucrose per gallon.	Canes.	Juice.	Sucrose in juice.
	Sq. ft.								Lb.	Tons.	Gals.	Tons.
B. 1753	6,360	62·6	1·0665	16·2	12·90	2·13	1·17	79·6	1·376	34·16	4,491	2·76
B. 16536	6,360	66·8	1·0639	15·6	12·29	2·23	1·08	78·8	1·307	30·82	4,335	2·53
B. 4934	11,000	59·8	1·0788	19·0	17·58	0·49	0·93	92·5	1·900	22·62	2,809	2·38
B. 6835	8,000	59·3	1·0828	19·9	18·43	0·51	0·96	92·6	1·996	21·71	2,663	2·37
B. 6450	6,360	65·6	1·0753	18·2	16·04	1·22	0·94	88·1	1·725	20·46	2,796	2·15
B. 3390	9,000	62·1	1·0678	16·5	12·68	2·45	1·37	76·8	1·354	26·68	3,476	2·10
B. 3922	6,360	61·0	1·0704	17·1	14·65	1·63	0·82	85·7	1·568	23·54	3,005	2·10
B. 6308	8,000	64·6	1·0709	17·2	14·93	1·53	0·74	86·8	1·599	21·17	2,860	2·04
B. 6388	6,360	64·0	1·0753	18·2	15·36	1·81	1·03	84·4	1·652	18·66	2,488	1·83
Bourbon	**6,360**	**66·4**	**1·0656**	**16·0**	**13·00**	**1·96**	**1·04**	**81·2**	**1·385**	**20·55**	**2,868**	**1·77**
B. 7169	9,000	57·7	1·0674	16·4	13·81	1·63	0·96	84·2	1·474	17·00	2,058	1·35
B. 4578	9,000	64·6	1·0687	16·7	13·31	2·23	1·16	79·7	1·422	15·43	2,089	1·33

TABLE V.—FIRST RATOONS—NURSERY NO. 2, ST. AUGUSTINE ESTATE.

Date planted ... December 10, 1914.
Plants reaped and tested May 11, 1916.—17 months old.
Ratoons reaped and tested May 15, 1917.—12 months old.
Rainfall ... May, 1916 to April, 1917.—45·22 inches.

CANE.		Area under cultivation.	JUICE.								PER ACRE.		
			Per cent. extracted.	Specific gravity.	Brix.	Percentage of			Quotient of purity.	Sucrose per gallon.	Canes.	Juice.	Sucrose in juice.
						Sucrose.	Glucose.	Non-Sugar.					
		Sq. Ft.								Lb.	Tons.	Gals.	Tons.
B.	6308	5,720	66·4	1·0895	21·4	19·84	1·04	0·52	92·7	2·161	30·17	4,119	3·97
B.	3922	5,720	67·0	1·0832	20·0	18·08	1·30	0·62	90·4	1·958	27·22	3,771	3·30
H.	146	5,200	61·9	1·0873	20·9	18·83	1·20	0·87	90·1	2·047	27·01	3,444	3·15
B.	6450	5,720	68·0	1·0801	19·3	16·49	1·17	1·64	85·4	1·781	27·41	3,865	3·07
B.	7169	5,720	65·4	1·0810	19·5	15·83	2·30	1·37	81·2	1·711	29·70	4,025	3·07
B.	4934	5,720	62·1	1·0868	20·8	18·50	1·17	1·13	88·9	2·010	25·51	3,265	2·93
B.	3390	5,720	63·0	1·0850	20·4	17·38	2·04	0·98	85·2	1·886	25·70	3,343	2·81
B.	6835	11,440	62·9	1·0964	22·9	20·58	0·78	1·54	89·9	2·256	20·42	2,624	2·67
B. N. H.	02 (5)	2,860	63·7	1·0810	19·5	16·64	1·94	0·92	85·3	1·799	23·42	3,091	2·48
H.	27	5,720	62·9	1·0891	21·3	17·81	1·91	1·58	83·6	1·940	21·99	2,845	2·46
H.	227	2,080	63·5	1·0832	20·0	16·97	1·52	1·51	84·8	1·838	22·51	2,956	2·42
B.	6388	11,440	65·6	1·0855	20·5	17·61	1·96	0·93	85·9	1·911	19·66	2,661	2·27
B.	4578	5,720	65·8	1·0819	19·7	15·19	2·27	2·24	77·1	1·643	21·13	2,879	2·11
Bourbon		**5,720**	**64·9**	**1·0828**	**19·9**	**17·46**	**1·68**	**0·76**	**87·7**	**1·890**	**18·09**	**2,429**	**2·05**
B. N. H.	02 (1)	2,860	62·9	1·0824	19·8	16·98	1·99	0·83	85·7	1·838	17·51	2,279	1·87

If we compare the results recorded in Tables IV and V, it will be seen that, with the exception of B. 6835, B. 4934 and B. 6450, none of the varieties were ripe at the beginning of March, when reaped as first ratoons at eleven months. These same varieties and B. 7169, B. 4578 and the Bourbon planted in Nursery No. 2 suffered from the severe drought which was experienced during the two months previous to reaping, when only 30 parts of rain were registered. A large proportion of the canes got sunburnt or over-ripe and had it been possible to reap them a month earlier, better results would have been obtained.

The results of the first ratoons from "Spring" plants from Field 3 are given in Table VI.

TABLE VI.—FIRST RATOONS—"SPRING" PLANTS, FIELD 3, ST. AUGUSTINE ESTATE.

Date planted ... ... May 15, 1915
Plants reaped and tested ... ... May 16, 1916 ... ... 12 months old.
Ratoons reaped and tested ... ... May 1, 1917 ... ... 11½ " "
Rainfall ... ... May 1916 to April 1917 ... ... 45·22 inches.

CANE.	Area under cultivation.	JUICE.								PER ACRE.		
		Per cent. extracted.	Specific gravity.	Brix.	Percentage of			Quotient of purity.	Sucrose per gallon.	Canes.	Juice.	Sucrose in juice.
					Sucrose.	Glucose.	Non-sugar.					
	Sq. ft.								Lb.	Tons.	Gals.	Tons.
D. 2468	22,550	65·5	1·0824	19·8	16·51	2·14	1·15	83·4	1·787	33·30	4,514	3·60
D. 145	22,352	62·4	1·0801	19·3	16·30	2·14	0·86	84·4	1·760	27·79	3,596	2·82
B. 147	21,824	67·3	1·0819	19·7	17·19	1·42	1·09	87·2	1·860	23·25	3,240	2·69
D. 504	21,217	62·5	1·0810	19·5	16·24	2·24	1·02	83·3	1·755	25·23	3,267	2·56
D. 109	22,220	64·6	1·0726	17·6	13·45	2·35	1·80	76·4	1·443	29·09	3,924	2·53
B. 1753	21,978	61·6	1·0757	18·3	15·30	1·81	1·19	83·6	1·646	25·17	3,229	2·37
B. 6835	21,428	61·8	1·0954	22·7	20·35	0·71	1·64	89·6	2·229	18·14	2,292	2·28
D. 116	21,692	63·5	1·0788	19·0	15·11	2·24	1·65	79·5	1·630	23·42	3,088	2·25
B. 3922	10,780	65·8	1·0810	19·5	17·54	1·27	0·69	89·9	1·896	18·28	2,492	2·11
B. 4934	6,734	59·0	1·0832	20·0	18·28	0·95	0·77	91·4	1·980	15·93	1,944	1·72

HAWAIIAN CANES.

The Hawaii canes were reaped as second ratoons on May 24, 1917, being approximately thirteen months old; the results are given in Table VII. The results of these same canes as plants, first and second ratoons are given in Table VIII; it will be seen that with the exception of H.? their yields obtained this year as second ratoons are better than those as plant canes.

TABLE VII.—HAWAIIAN VARIETIES—SECOND RATOONS.

Cane.	Area under Cultivation.	Juice.								Per Acre.		
		Per cent. extracted.	Specific Gravity.	Brix.	Percentage of			Quotient of purity.	Sucrose per gallon.	Canes.	Juice.	Sucrose in juice.
					Sucrose.	Glucose.	Non-Sugar.					
	Sq. ft.								Lb.	Tons.	Gals.	Tons
H. 27 ...	1100	64·7	1·0792	19·1	15·88	1·90	1·32	83·1	1·714	34·65	4653	3·56
H. 146 ...	3520	64·8	1·0828	19·9	17·27	1·62	1·01	86·8	1·870	26·45	3546	2·96
H. 227 ...	1100	65·5	1·0757	18·3	15·50	1·55	1·25	84·7	1·667	27·72	3781	2·81
H. ? ...	2640	62·3	1·0828	19·9	17·46	1·37	1·07	87·7	1·890	21·45	2764	2·33

TABLE VIII.—HAWAIIAN VARIETIES—PLANT CANES, FIRST AND SECOND RATOONS.

Cane.	Sucrose in Juice—Tons per acre.			
	Plant Canes—17 months old.	1st Ratoons—11 months old.	2nd Ratoons—13 months old.	Average for 3 years.
H. 27 ...	2·64	1·68	3·56	2·63
H. ? ...	3·18	2·26	2·33	2·59
H. 146 ...	2·38	1·29	2·96	2·21
H. 227 ...	1·95	1·33	2·81	2·03

AVERAGE YIELDS.

TABLE IX.—AVERAGE RESULTS OF PLANT CANES AND FIRST RATOONS, GROWN IN NURSERIES NO. 1, NO. 2, FIELDS 6 AND 3, ST. AUGUSTINE ESTATE.

CANE.	SUCROSE IN JUICE.—TONS PER ACRE.		
	Plant canes about 18 months old.	1st Ratoons about 12 months old.	Average for 2 years.
B. 1753	4·71	2·82	3·76
B. 208	4·63	2·45	3·54
B. 156	4·61	2·12	3·36
D. 504	3·44	3·18	3·31
B. 6308	3·98	2·62	3·30
D. 145	4·54	1·99	3·26
B. 16536	3·90	2·60	3·25
H. 227	3·98	2·42	3·20
Badilla	3·68	2·60	3·14
H. 146	3·06	3·15	3·10
B. 6450	3·69	2·50	3·09
B. 3922	3·66	2·46	3·06
D. 109	3·97	2·07	3·02
T. 75	3·91	2·13	3·02
B. 4934	3·26	2·69	2·97
B. 6835	3·42	2·52	2·97
D. 366	3·35	2·58	2·96
T. 202	3·13	2·78	2·95
B. 7169	3·72	2·17	2·94
B. 3859	2·91	2·78	2·84
D. 3956	3·60	1·95	2·77
B. 6388	3·19	2·17	2·68
B. 347	3·46	1·83	2·64
B. 3390	2·92	2·36	2·64
D. 4397	3·81	1·41	2·61
H. 27	2·73	2·46	2·59
D. 116	3·81	1·31	2·56
D. 2468	3·02	2·07	2·54
B.N.H. 02 (1)	3·11	1·87	2·49
T. 39	2·93	1·99	2·46
D. 115	2·59	2·16	2·37
D. 464	2·84	1·79	2·31
B. 4578	2·75	1·83	2·29
D. 4395	2·58	1·97	2·27
B. 3412	2·86	1·68	2·27
B.N.H. 02 (5)	1·85	2·48	2·16
Bourbon ...	**2·63**	**1·63**	**2·13**
B. 16832	1·80	1·65	1·72

NEW VARIETIES.

Small plots of the following recently introduced varieties were reaped and the juice tested at the end of May 1917. The results are given in Table X.

The varieties with an L. prefixed are Louisiana seedlings, those with an M. or M.P. as also the White Tanna were obtained from Mauritius.

The plant canes from approximately a quarter of an acre of Ba. 6032 gave 21·29 tons of cane per acre and the first ratoon plot, from a thirteenth of an acre, 26·26 tons of cane per acre. The canes from both of these plots were heavily topped for obtaining plants.

TABLE X.—NEW VARIETIES—ST. AUGUSTINE ESTATE.

CANE.	Date planted.	JUICE.							
		Per cent. extracted.	Specific gravity.	Brix.	Percentage of			Quotient of purity.	Sucrose per gallon.
					Sucrose.	Glucose.	Non-Sugar.		
									Lb.
Ba. 6032 (Ratoons)		64·0	1·0923	22·0	20·51	0·62	0·87	93·2	2·240
B. 14761 ...	24/12/15	65·2	1·0914	21·8	20·09	0·92	0·79	92·1	2·193
B. 7482 ...	10/12/15	63·7	1·0914	21·8	20·05	0·75	1·00	92·0	2·188
L. 511 ...	19/ 1/16	61·1	1·0886	21·2	19·05	0·52	1·63	89·8	2·074
Striped ..	18/ 2/16	60·4	1·0828	19·9	18·52	0·56	0·82	93·1	2·005
B. 18208 ...	24/12/15	62·7	1·0846	20·3	18·46	1·11	0·73	90·9	2·002
Ba. 6032 (Plants)	8/ 1/16	64·4	1·0824	19·8	18·11	0·81	0·88	91·5	1·960
M.P. 55 ...	15/12/15	65·1	1·0824	19·8	17·73	1·31	0·76	89·6	1·919
B. 10650 ...	24/12/15	69·3	1·0806	19·4	17·28	1·40	0·72	89·1	1·867
L. 253 ...	19/ 1/16	58·3	1·0846	20·3	17·19	0·56	2·55	84·7	1·864
B. 17380 ..	24/12/15	65·9	1·0824	19·8	16·94	1·88	0·98	85·5	1·833
White Tanna ...	15/12/15	61·2	1·0797	19·2	16·28	1·34	1·58	84·8	1·758
M. $90^{\underline{08}}$ ...	20/12/15	58·4	1·0726	17·6	15·69	0·85	1·06	89·1	1·683
M. 1237 ...	20/12/15	52·7	1·0652	15·9	12·88	1·85	1·17	81·0	1·372

CACAO.

CACAO SPRAYING EXPERIMENT, 1916-1917.

By James Birch Rorer,
Mycologist, Board of Agriculture.

A spraying experiment, for the purpose of testing the value of a combination of Bordeaux mixture and nicotine sulphate, as a control measure for the Phytophthora or black rot of pods and thrips was made last year.

For the experiment, a field on an estate at Sangre Grande, which in previous years had been very badly attacked by thrips, was selected. The field contained 1,200 trees, and was divided into three plots of 400 trees each. One plot was sprayed, while the remaining two plots were left unsprayed as control. The whole field was very even in general appearance, and had always received the same treatment throughout in regard to pruning, draining, forking, &c. The block of 400 trees, bordering the road, was selected for spraying, because trees in such situations are always more severely attacked by thrips than those farther within the cultivation, and it was desired to make the test as thorough a one as possible.

The trees were sprayed three times, August 23, September 14 and October 19. At each spraying, 400 gallons of mixture were used, made on the following formula:—5 lb. bluestone, 5 lb. lime to every 50 gallons (American) of water, to which was added 5½ ounces of "black leaf 40." It took two days and a half to spray the trees the first time, because the work was interfered with by rain, but on the other two occasions, the trees were sprayed in one, and in one and a half days respectively. The mixture was made in the usual way in fifty gallon barrels, and the spraying was done with a spray motor pump No. 2, mounted on a barrel, with two fifty foot leads of hose and ten foot bamboo rods. Friend angle nozzles were used. On each occasion, six men were employed.

On August 23, the time of the first spraying, the trees were quite well covered with young chirellos, and adult thrips were fairly numerous on the young leaves, especially those on chupons, and were evidently laying their eggs in the leaf tissue.

The second spraying on September 14 was made chiefly for the purpose of giving the young fruits additional protection from black rot, and to kill any thrips which had hatched out since the first spraying. Between this spraying and the third spraying, the trees had made a considerable amount of new growth, and some of the young leaves especially along the borders of the sprayed plot, were being used by adult thrips for egg-laying, so that the third spraying was made for the purpose of killing these thrips and also to give the fruit additional protection.

The first picking was made on November 22, and thereafter pickings were made at intervals varying from 3 to 6 weeks, until June 11, after which time, there was practically no fruit left on the trees.

Last year, both thrips and black rot did a great amount of damage throughout the Sangre Grande district, and a marked difference could be seen between the sprayed and the unsprayed trees as early as the middle of November, and from that time on the difference became more and more marked, until the end of the crop. The unsprayed trees of the experiment, as well as unsprayed trees on adjacent fields and estates, were very badly attacked by thrips, and were almost defoliated towards the end of the year, which naturally resulted in a distinct loss of crop. On the other hand, the sprayed trees remained in full foliage during the whole time that they were under observation, and produced a very good crop of cacao.

The plots were visited by His Excellency the Governor, President, and the members of the Board of Agriculture, and planters of the Sangre Grande district, on January 4, and all were impressed by the striking difference in appearance of the sprayed and the unsprayed trees.

My thanks are due to Messrs. Andrew and Vernon Maingot for all the facilities which they gave me for carrying out the experiment on Concord Estate; and it is hoped that the experiment may be carried out again this year on the same plots in order that results of two years successive spraying may be obtained.

The following table shows the results of the pickings from the sprayed and one of the unsprayed plot of an equal number of trees. It shows conclusively that it is advantageous to spray cacao in districts where the Phytophthora rot is prevalent, and where the trees are subject to repeated attacks by thrips, for without any additional manuring, drainage, or other cultivation, the 400 sprayed trees yielded 4,371 more pods and 4,765 more sound pods than the control trees, and the crop was extended to the middle of June. Only 9 per cent. of the fruit from the sprayed trees was affected with black rot, while 21 per cent. of that from the control was so affected.

Date of picking.			Total Pods.		Sound Pods.		Black Pods.		Per cent. Black.	
			Sprayed.	Control.	Sprayed.	Control.	Sprayed.	Control.	Sprayed.	Control.
November	22,	1916 ...	817	521	682	341	135	180	16·5	34·5
December	11,	,, ...	1,825	1,420	1,630	970	195	450	10·7	31·7
January	4,	1917 ...	1,868	1,422	1,632	1,028	236	394	12·6	27·7
,,	25,	,, ...	1,898	1,445	1,773	1,296	125	149	6·6	10·3
February	22,	,, ..	1,287	675	1,212	616	75	59	5·8	8·8
March	20,	,, ...	1,081	525	1,045	478	36	47	3·0	8·9
April	24,	,, ...	947	365	855	290	92	75	9·6	20·4
June	11,	,, ...	1,198	177	1,104	149	94	28	7·9	16·0
Total ...		...	10,921	6,550	9,933	5,168	988	1,382	9·0	21·1

Although each picking from the sprayed and unsprayed trees could not be dried separately, the wet cacao was always weighed and the amount of dried cacao was estimated from drying experiments made with larger amounts. Based on these experiments the 400 sprayed trees gave 1,082 pounds dried cacao, while the 400 unsprayed trees gave 572 pounds. This means 17 bags per 1,000 for the sprayed trees and little less than 9 for the unsprayed.

The cost of the spraying was as follows :—

120 lb. bluestone at 8 cts.	$ 9.60
120 „ lime	72
1 gallon "Black Leaf 40"	10.00
Labour, 6 men for 4 days at 40 cts.	9.60
Total	29.92

When spraying is done on a large scale the cost of the labour would be less than shown above for the experiment, because 6 men will spray from 500 to 600 trees per day. In a small experiment a certain amount of time is wasted in carrying pump, rods, etc. to and from the field at each spraying.

The above figures show that the spraying, even three times, of trees which are well cultivated, pays well; the writer realises that it is not possible to do this on large areas, but from other experiments and other spraying which he has seen it is very evident that every spraying more than pays for itself, even if the trees are only sprayed once. Each spraying helps to reduce the amount of black cacao and to kill thrips.

METEOROLOGY.

RAINFALL RETURN JULY TO SEPTEMBER, 1917.

Stations.	July.	August.	Septr.	Total Jan. to Sept. 1917.	Total Jan. to Sept. 1916.
North-west District.	Ins.	Ins.	Ins.	Ins.	Ins.
St. Clair—Royal Botanic Gardens	10·13	9·96	7·24	43·98	51·75
Port-of-Spain—Colonial Hospital	10·11	10·48	5·56	38·33	36·62
,, Royal Gaol...	10·24	10·46	6·78	40·62	40·40
,, Constabulary Headquarters	8·77	8·96	5·72	38·51	41·13
St. Ann's—Reservoir	12·61	14·21	9·66	57·16	54·64
Maraval— ,,	12·96	13·96	6·19	50·44	62·72
,, Constabulary Station	15·49	17·77	7·01	59·79	62·90
Diego Martin—Constabulary Station	17·21	15·37	10·99	64·57	61·79
,, Waterworks ...	15·20	13·53	8·64	55·66	55·19
,, River estate ...	11·98	13·11	7·89	50·31	54·43
Fort George Signal Station ...	12·14	9·85	8·05	43·57	54·33
North Post ,,	11·07	12·70	5·02	42·68	47·24
Carenage Constabulary Station	12·72	14·90	6·87	55·18	62·17
Carrera Island Convict Depôt	4·06	3·24	1·42	15·86	38·02
Chacachacare Lighthouse ...	9·70	8·39	5·72	39·05	29·36
Santa Cruz—Maracas District.					
Santa Cruz—Constabulary Station	20·66	20·11	8·07	69·00	70·22
St. Joseph—Government Farm	11·39	9·26	9·02	46·09	39·17
,, Constabulary Station	10·51	10·01	8·16	42·37	32·59
Tunapuna—St. Augustine estate	11·14	8·51	5·32	38·57	34·02
Maracas—Government School	19·40	14·35	6·60	60·84	69·05
,, Ortinola estate ..	15·59	13·47	7·92	55·85	61·05
Caura—Wardour estate ...	14·04	8·20	6·96	47·35	50·59
West Central District.					
Caroni—Frederick estate ...	11·66	9·82	5·97	40·50	39·39
Chaguanas—Constabulary Station	14·00	12·31	5·17	45·62	36·66
,, Woodford Lodge estate	11·70	8·37	4·80	37·90	37·39
Carapichaima—Waterloo estate	15·52	8·21	4·49	44·18	42·89
,, McBean Cacao estate	11·89	8·97	5·23	39·29	...
,, Friendship Hall estate...	10·50	8·00	8·25	42·30	34·50
Couva—Exchange estate ...	12·26	11·31	3·98	39·63	39·09
,, Brechin Castle estate	11·49	11·77	4·73	41·94	46·65
,, Perseverance ,,	10·63	9·84	3·22	36·95	40·66
,, Camden ,,	10·19	9·93	5·15	36·32	36·51
,, Milton ,,	13·12	9·52	6·67	44·09	52·31
,, Spring ,,	12·86	9·83	5·22	46·83	44·54
,, Constabulary Station	5·87	6·74	6·35	25·06	44·66
,, Esperanza estate, Savonetta	9·80	9.54	4·03	36·91	47·40
Montserrat District.					
Montserrat Constabulary Station	12·17	8·21	7·18	42·87	46·74
Brasso—La Vega estate ...	16·34	10·37	11·18	61·55	52·19
Brasso-Piedra—Mamoral ...	19·26	8·19	12·32	62·56	
,, La Mariana ...	15·12	6·88	13·70	58·59	...
Arima District.					
Arima—Warden's Office ...	*	8·90	10·24	...	44·44
,, Torrecilla estate ...	17·07	10·55	13·14	64·98	56·35
,, Verdant Vale estate	15·86	11·24	11·73	60·14	63·97
San Rafael—Constabulary Station	18·58	11·52	9·45	64·11	49·56
Guanapo—Talparo estate ...	23·44	10·91	13·36	72·41	49·90
,, San José Estate	20·79	9·98	13·09	69·24	64·09
Tamana—Sta. Marta estate ...	23·96	11·96	14·97	81·29	69·03
,, La Corona estate ...	19·83	10·80	11·66	72·69	80·76
San Fernando & Princes Town District.					
Claxton's Bay—Forres Park estate	9·00	8·38	5·40	35·85	48·08
Pointe-à-Pierre—Bonne Aventure est.	13·93	9·02	5·92	42·36	44·08
,, Concord estate	14·27	9·50	8·11	48·40	45·12
,, Plein Palais estate	15·85	9·82	5·50	48·15	41·34
Naparima—Picton estate ...	18·28	8·98	5·92	49·98	42·13
,, Usine St. Madeleine	15·91	9·28	5·24	44·67	46·30
,, La Fortunée estate	17·65	9·59	6·48	48·47	41·25
,, Lewisville ...	23·59	12·49	6·98	60·12	55·21
Tarouba estate	15·98	9·92	5·27	41·51	33·31

* No record.

RAINFALL RETURN—JULY TO SEPTEMBER, 1917.—CONTD.

Stations.	July.	August.	Septr.	Total Jan. to Sept., 1917.	Total Jan. to Sept., 1916.
San Fernando and Princes Town District.—(Contd.)	Ins.	Ins.	Ins.	Ins.	Ins.
Naparima—Union Hall estate	20·50	11·79	5·99	54·23	45·53
,, Palmiste ,,	23·06	14·09	6·17	65·12	47·38
,, Hermitage ,,	19·06	9·71	6·18	49·44	38·00
,, Petit Morne ,,	17·26	9·25	5·48	42·96	42·91
Princes Town—Craignish estate	12·62	7·52	5·41	36·59	47·75
,, Cedar Hill estate	15·38	9·66	...	...	47·79
,, Williamsville estate	11·16	9·29	5·00	39·46	53·11
,, Esmeralda estate	13·85	8·45	9·56	50·85	46·93
,, New Grant estate	12·36	8·80	8·27	46·51	52·17
,, Constabulary Station	13·44	6·68	4·79	36·55	43·98
,, Hindustan estate	13·57	9·02	12·29	49·14	56·13
,, La Retraite estate	17·88	13·64	8·47	64·99	75·12
,, Malgretoute estate	15·96	8·77	5·15	44·46	53·38
Savana Grande—Friendship & Ben Lomond estates	16·27	9·23	5·74	46·56	51·68
,, Los Naranjos estate	18·73	9·00	8·07	51·15	...
Poole—El Rosario estate ...	21·95	9·66	8·22	64·06	64·42
South-west District.					
Oropuche—Constabulary Station	17·49	13·13	7·47	55·64	44·21
,, Pluck estate	18·43	9·97	3·84	44·36	42·63
Siparia—Constabulary Station	17·06	11·27	8·99	55·08	43·19
,, Alta Gracia estate	16·55	11·02	9·18	54·34	49·39
Guapo—Adventure estate	15·90	15·26	9·38	59·68	48·82
Cap-de-Ville—Constabulary Station	20·07	17·96	10·87	72·27	59·04
Erin—La Ressource estate	15·39	10·60	4·97	52·44	31·42
,, Industry estate ...	18·54	8·51	8·36	56·41	38·75
,, La Union estate ...	17·34	9·66	6·16	55·70	38·83
Cedros—La Retraite estate	16·79	17·30	10·36	69·07	66·61
,, Beaulieu estate	12·43	12·04	9·51	53·92	41·78
,, St. Marie estate	16·25	13·85	11·51	61·66	42·99
,, St. Quintin estate	11·50	13·48	11·12	53·45	...
,, Constabulary Station	14·71	14·54	10·67	59·99	43·21
,, Perseverance estate	14·53	15·13	12·24	61·01	43·63
Icacos—Constance estate ...	30·30	29·40	25·30	111·40	53·35
Irois—Government School...	18·02	12·91	13·02	74·62	56·02
South Coast.					
Moruga—Constabulary Station	15·99	11·77	7·24	53·65	51·78
East Coast.					
Matura—La Juanita estate	13·63	16·99	10·56	69·02	60·73
Manzanilla—Constabulary Station	18·01	11·66	15·12	70·69	55·94
,, Indrasan estate	18·76	14·61	12·83	...	...
,, San Francisco estate	18·20	10·27	13·70	...	...
Sangre Grande—San Hilario estate	14·82	9·68	14·78	63·87	55·25
,, New Lands estate	22·39	11·62	12·56	78·85	61·85
,, Evasdale estate	21·31	9·21	10·34	66·74	64·15
,, Grosvenor estate	22·51	10·23	12·54	75·61	62·79
Mayaro—Constabulary Station	15·63	8·32	9·00	55·49	59·44
North Coast.					
Blanchisseuse—Constabulary Station	16·69	15·07	8·32	66·29	55·86
Grande Rivière—Mon Plaisir estate	16·52	11·32	12·84	67·34	72·74
Toco—Aragua House	15·22	8·28	11·55	54·77	57·14
,, Constabulary Station	14·81	8·83	16·21	60·99	48·69
Point Galera—Light House	13·01	8·00	12·83	49·72	38·22
Tobago.					
Tobago—Hermitage estate	22·35	3·27	20·84	68·99	67·48
,, Riversdale ,,	18·26	7·19	12·07	58·48	54·40
,, King's Bay ,,	16·69	5·65	19·68	67·69	63·47
,, Roxburgh	18·00	7·47	13·79	65·81	71·30
,, Lure estate	17·16	9·81	12·58	59·96	58·15
,, Botanic Station	11·74	10·99	11·61	52·09	45·24
,, Government Farm	9·09	9·63	8·10	38·34	35·31
,, Lowlands estate	13·47	...	...	...	39·56
,, Friendship estate	10·68	8·66	8·44	39·17	39·51
,, Bon Accord estate	12·14	7·94	...	...	34·89

NOTES.

The Government has opened a Ground Provisions Depôt at Port-of-Spain. The Manager is Mr. J. J. Beard, one of the Agricultural Instructors of the Education Department, who has been temporarily seconded to the Department of Agriculture. Full particulars of the working of the Depôt have been given by posters, handbills and by the daily advertisements in the newspapers.

Mr. J. B. Rorer, Mycologist of the Board of Agriculture, has been granted six months leave from November 15. During his absence Mr. F. W. Urich, the Entomologist, will act as Honorary Secretary of the Board of Agriculture.

Mr. J. J. Cumberbatch has been appointed to act as Agricultural Adviser during the absence on leave of Mr. F. T. Farfan. His headquarters are at Sangre Grande.

The British Honduras Mahogany trees at River Estate are now fruiting heavily. The seeds will be ripe during November. Orders should be sent in immediately to the Acting Manager River Estate, or the Curator St. Clair Experiment Station. The price charged for seeds is $1.00 per 1,000, freight extra.

Orders for seeds of Robusta Coffee should also be placed now with the Manager of River Estate as the crop will be ripe early in December. Price 20 cents per lb. of ripe "cherries"; freight extra.

The judging of the Rice Competition of the Board of Agriculture will commence very shortly. Great interest has been taken in the competition and useful results are anticipated.

(*Bulletin, Department Agriculture, Trinidad & Tobago*, pp. 95-170. Issued Oct. 26, '17).

BULLETIN
OF THE
DEPARTMENT OF AGRICULTURE
Trinidad and Tobago.

PART 4.] 1917. [VOL. XVI.

Our Food Supply in 1918.—The increased crops of ground provisions planted in 1917 will doubtless provide a good supply for the early months of the year. All those who can will be well advised to lay in a stock of yams which will keep for several months or even a year. During the dry months of the year supplies, for the house, of dried sweet potatoes, dasheen, meals, cassava farine, &c., can also be prepared according to directions which have already appeared in this *Bulletin* (Vol. XVI, 1917, part 2).

There is no indication at present that during 1918 the supplies of imported foodstuffs will be more abundant or cheaper. Europe will apparently be more dependent than ever on outside sources of supply, as more and more demands are made on the population of the fighting nations for men and war supplies. The entry of the United States into the war and the transport of her armies will make increased demands on the already limited number of available ships. As stated by the British Prime Minister on December 15: "Nothing can defeat us but the shortage of tonnage, and the advent of the United States has increased the tonnage problem enormously . . . . Both America and Great Britain will have to strain their resources to the utmost to increase their tonnage. The fact that American tonnage will be absorbed in the transport of their own armies compels us to increase our responsibilities in assisting France and Italy with the transportation of essential commodities to their shores. In order to obtain the necessary men for this object, we must interfere to a greater extent than heretofore with industries not absolutely essential to the prosecution of the war." In conclusion, Mr. Lloyd George emphasized how the country could aid by further economizing and in the increase of home production.

In our own interests therefore it is essential that we should produce all we can of our own food supply, both because of so doing we can reduce the high cost of living and also by requiring less imported goods, make less demands on the limited amount of available shipping.

In 1918 therefore let every one plant as far as possible to meet their own requirements and when practicable to have a surplus to sell for those who are not able to produce foodstuffs for themselves.(1)

Trinidad Seedling Canes.—The raising of seedling canes in Trinidad has been discontinued for many years, excepting what has been done on one or two private estates. A proposal that the work should be taken

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(1.) See also note on p. 175.

up again was recently considered by the Sugar Committee of the Board of Agriculture, on the initiative of His Excellency the Governor. The following proposals of the Committee were subsequently approved by the Board, and work has been commenced.

The Chairman, Mr. W. G. Freeman, presented to the Committee a brief summary of the methods employed in raising seedling canes in British Guiana, Barbados, Java, &c. After a general discussion, the Committee decided that it is desirable that seedling canes should be raised in Trinidad. These have in the past been obtained almost exclusively by introduction of Barbados and British Guiana seedlings. The sugar industry of the Colony has greatly benefitted by the work of the Department of Agriculture of Barbados and British Guiana in raising seedling canes. As however canes are markedly affected by soil and climatic conditions, it is probable that, by raising seedlings locally, canes still more suitable to local conditions may be obtained.

Owing to the fact that cane varieties tend to deteriorate in yield after a more or less prolonged period, it is necessary continuously to secure new varieties.

The Committee suggested therefore that such raising of seedlings should be carried out in Trinidad at two or three places representative of the chief sugar producing districts. The places suggested are St. Augustine Experiment Station (Department of Agriculture), Brechin Castle, and an estate in the Naparima district. The seedlings should be raised from selected canes, the arrows being bagged so that the seed is either the result of self-pollination or of crossing between two known good varieties. The Committee recommended that at St. Augustine Estate the work be carried out by the Department of Agriculture officers, and that the authorities of the private estates be asked if they would undertake the raising and cultivation of seedling canes at their own expense, the Department of Agriculture giving advice and assistance in obtaining the seed, raising the young plants and in the work of selection.

The Committee approved of the suggestion of the Acting Director of Agriculture that Mr. W. E. Broadway, Horticulturist and Assistant Botanist might be entrusted with the supervision of the task of obtaining the seed and raising the young seedlings.

Co-operative Lime Factory.—Mr. H. Meaden, Officer in Charge of the Botanic Station and Manager of the Government Farm, Tobago has returned from St. Lucia where he had gone to study the working of the Government Co-operative Lime Factory in connection with the proposed establishment of a factory on similar lines in Tobago. The St. Lucia factory was the first factory of its kind in the West Indies, and has just been considerably enlarged and improved. The example of St. Lucia has already been followed in British Guiana, and steps are now being taken for the establishment of a similar factory in Dominica. Such factories are equally advantageous to the peasant and the larger proprietor, as the latter with perhaps only a comparatively small area in limes will thus not be put to the necessity, whilst the industry is in a more or less experimental stage, of sinking capital in building and machinery.

The Ground Provision Depôt.—The depôt in Port-of-Spain, established on the recommendation of the Ground Provision Committee, is situated close to the Light House Jetty and Railway Station. It was opened in October under the managership of Mr. J. J. Beard, one of the Agricultural Instructors of the Education Department. Publicity has been given to the work of the depôt by posters, circulars, &c., which have been distributed widely throughout the Colony. One leaflet was prepared particularly for use in schools, and by the co-operation of Mr. Hancock, Inspector of Schools, used as a reading lesson in suitable standards. Another circular, asking for assistance in increasing the local food supply of the Colony has been sent to the estates, and also distributed through the Agricultural Society and its affiliated District Societies. The five Agricultural Advisers of the Board of Agriculture have for the greater part of the year devoted their main energies to the encouragement of the cultivation of food products.

Corn on the Cob for Feeding Stock.—Oats and bran formed the principal part of stall food given to horses and mules in Trinidad before the war, but at present it is very desirable that a substitute for oats should be found as far as practicable without detriment to the health and working powers of the animals. In the United Kingdom the use of oats is actually prohibited as shown by the following extract paragraph from the Proclamation of His Majesty the King:

"And we do also in like manner exhort and charge all persons who keep horses to abandon the practice of feeding the same with oats or other grain unless they shall have received from our Food Controller a license to feed horses on oats and any other grain, to be given only in cases where it is necessary to do so with a view to maintain the breed of horses in the national interest."

Whilst in this Colony there is no legal restriction on the use of oats or other cereals their very high price has naturally the effect of reducing their consumption.

The animals at the St. Clair Experiment Station are now being fed with one-third the quantity of oats formerly used, and two-thirds the amount of bran; corn on cob being used as a substitute for the balance. The chief object of combining the cob with the food is to give the needed bulk and the crushing of the grain makes it more readily digestible. Advantage is taken of odd labour during showery weather for the grinding which on a small scale for a few animals is effectively done by means of a small $10 corn mill bought locally. As the animals get used to the change of food, it is intended still further to reduce the supply of oats till it can be dispensed with completely, using more crushed corn on cob, beans, peas, &c., instead.

The cost of feeding with the present mixture as compared with that when oats and bran were used as the principal foods shows a saving of about 40 per cent., taking corn on the cob at 6s. per barrel of 100 lb. although it was actually grown in the Experiment Station.

At least one power mill, to grind corn on the cob has been successfully used in Trinidad for some years on a private estate. One is expected very shortly for the Government Farm, with a special attachment for grinding cotton seed also. By its use it is anticipated that the quantity of imported stock feed hitherto purchased by the Farm will be greatly reduced, and a considerable saving in cost effected.

Drying and Storing Corn.—The equipment for kiln drying corn at the Government Farm has now been completed by the erection of two reinforced concrete bins with a capacity of 1,582 cubic feet each. To house the new plant it was necessary to make considerable structural alterations, resulting in practically a new two storey building, 65 feet by 35 feet. The top floor is available as a large drying space and when corn on the cob or other produce can be stored. From this floor the corn on the cobs pass through a shoot to the shellers. An elevator will shortly be added to feed the shelled corn into the top of the kiln drier, and after its passage through that to the top of the storage bins. A mill has also been added for making corn meal. The sheller, mill, and the corn and cob mill referred to in the preceding note, are driven by the Petter Oil Engine, which is also available for driving the cotton gin, and the small mill for sampling canes for the experiment plots. The kiln drier has its own boiler.

Tous les mois for Pigs.—Tous les mois, a small flowering canna (*Canna edulis*) is abundant in this Colony as in many other parts of the tropics, and is often to be seen in the gardens of the peasantry and also running wild where it has escaped from cultivation. The underground rhizomes or root-stocks are rich in starch, like the ordinary arrowroot to which it is closely related. They can be boiled and eaten by human beings, and also used for the preparation of starch. In Queensland the plant is cultivated on a moderate scale and the starch prepared from it is known in commerce as Queensland arrowroot.

The plant is easily grown by planting pieces of the rootstock about one foot apart in rows 3 to 4 feet apart. It takes about 6 to 8 months to come to maturity. No local figures as to yield are available but it is stated to be about 15 tons per acre.

Attention has recently been directed to the *Tous les mois* plant in Hawaii as worthy of consideration for cultivation as a food for pigs. (1) One point urged in its favour is that the dug rootstocks, stored in ordinary bags, showed practically no loss from decay for a period of three months "thus indicating the ease and simplicity with which it can probably be handled in a damp, rainy climate where much loss might be expected."

The following analyses made in Hawaii show that in composition the *Tous les mois* rootstocks closely resemble the ordinary potato. It will be noted that the pieces five or six inches in length are of much higher starch content than the small, presumably younger pieces, about two inches long:

Constituents.	*Small rootstocks.*	*Large rootstocks.*
Water	81·58 per cent.	65·86 per cent.
* Starch, Sugar, &c. ..	15·57 ,,	31·34 ,,
Protein	1·37 ,,	1·20 ,,
Fat	·13 ,,	·15 ,,
Crude fibre ...	·54 ,,	·64 ,,
Ash	·81 ,,	·81 ,,

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* *i.e.* Nitrogen free extract.

(1.) Report of Hawaii Agricultural Experiment Station, 1916.

An Excellent Example in Food Economy.—The authorities of Diego Martin found it impossible to maintain the institution the Boys' Reformatory on its former grant, as however it is doing at present without the substitution of native vegetables for imported foodstuffs.

For the past four months no imported food except corn meal has been used, and the boys appear to be more healthy and physically better than when the diet consisted of rice, flour and other imported food. The authorities at the Reformatory will never again use imported foods to the extent they did in the past, if ground provisions are obtainable. It has been found that the native vegetables when properly cooked and served are more appreciated than the former diet.

At present at least 50 per cent. of the expense of feeding the inmates of that Institution (approximately 220) is being saved by the use of locally grown foods such as sweet potatoes, dasheen, tannias, yams, eddoes, pumpkins, salad beans, pigeon peas, ochroes, melongenes, cassava farine, etc.

For two meals a day boiled vegetables together with salt fish or meat are served. The other meal consists of vegetable soup. Breadfruit forms an important article in the diet and it is important to note that bread is no longer used.

There need be no fear of overplanting ground provisions. It has been found necessary to purchase imported vegetables in large quantities to maintain this Institution alone as on a vegetable diet even a small Institution of this kind would consume 15,000 lb. of provisions per month a quantity which cannot be obtained at present of local produce.

The Reformatory was during 1917 buying most of its vegetables, but arrangements have been made to take over an area of land where it is hoped to grow a large part of the vegetables required, this should result in a further saving in cost.

The authorities of the Reformatory find that cassava farine forms an excellent article of food, and have now in working order a plant made on the premises, capable of grinding 2,000 lb. of cassava per week and of extracting the by-products of starch and farine.

It was pointed out that by using sweet potatoes instead of bread, a saving of $4.00 was effected on the previous total cost, $6.90 for one meal alone.

Our Food Supply.—The note on p. 171 was written towards the end of December before going on leave. Finding the *Bulletin* still "in the press" on my return, it is necessary to emphasize that the position is now, in February-- far more serious. As is already known the United States Government has found it necessary to control the amount of foodstuffs exported to West Indian Colonies and supplies can only be obtained by special licenses. The quantity which the United States can spare, or the number of the ships available for its transport may at any moment be reduced. Official notification has also already been given of the withdrawal of two of the four boats of the Canadian West Indian Service. The Colony must thus rely much more completely on its own resources and it is imperative on all to take every possible step to live without using imported goods more than is absolutely necessary.

W. G. F.

CACAO.

ESTATE EXPERIMENTS, 1910-1917.

BY JOSEPH DE VERTEUIL, F.C.S.,
Superintendent of Field Experiments.

THIS report contains the results of the Experiments carried out at River Estate (Department of Agriculture) and on private estates in both Trinidad and Tobago; the cost of manures in the latter experiments were defrayed by the Board of Agriculture.

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RIVER ESTATE EXPERIMENTS.

When the Manurial, Shade and Chupon experiments were planned in 1910 it was assumed, as appears to have been generally done wherever experiments on cacao had previously been conducted, that all the plots would give approximately the same yield under *natural* conditions *i.e.*, if no special work or treatment was done to the plots.

After the first year's yield of the various plots at River Estate had been recorded and calculated to a uniform basis, the results obtained were so varied and unexpected that there was little doubt in my mind that there must be some powerful factor or factors other than the application of manures or special treatment which influenced the yield of the trees on the different plots. Subsequent results have still further confirmed this opinion, *vide* results from *natural* yield of plots. (1.)

Accordingly certain factors, such as the chemical composition and physical condition of the soil, the average size of the trees (2) and the number of immortel trees in each plot, were carefully examined in Field

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(1.) *Bull., Dept. Agr., T'dad & T'bgo.* XV. 1916, 130-132 and 193-196.
(2.) *Bull., Dept. Agri.,* XI. 1912, 49-55.

No. 1 at River Estate in the hope of finding an explanation of the large variation in the yield. These investigations led me to the conclusion that these factors have but a slight influence on the full bearing cacao tree and that the greatest and most important factor determining the yield would probably be found in the relative productiveness of the particular trees forming the plot. All cacao planters know that certain trees on their estates bear most prolific crops year after year, whereas whilst other trees in their immediate vicinity may give but a few pods yearly. It appeared to me that, what was true of a single tree would also be true for blocks of 25, 50, 100 or more trees though the variations might not be so great as with single trees.

Acting on the above supposition, a large number of plots were marked out in 1912 and the trees labelled in several fields at River Estate and on eight estates situated in various parts of the Colony for ascertaining the *natural* yield of plots and of individual trees. No manures of any kind were or have since been applied to these plots and, as far as each field is concerned, the cultural treatment of the plots has been identical. The results obtained to August 31, 1915 have been regularly published, (1) but those for the past two years are not given in this report as they disclose no new facts; they only confirm previous observations. The detailed figures, however, may be consulted in the record books at the office of the Superintendent of Field Experiments.

The following are the conclusions which have been arrived at :—

1. The difference between the yield of one crop and another for the same plot is undoubtedly due to seasons, and to the increasing age of the trees (when these have not yet attained their full bearing capacity) although the increase in yield from the latter cause may not be very marked in each year.

2. The variation in the yield between the various plots in each field—where conditions are practically identical—for the same crop, is due to the relative productiveness of the particular group of trees forming each plot and is largely dependent on the relative proportion of heavy and poor-bearing trees thereon.

3. These variations are not uniform, that is the plots do not increase or decrease in the same proportion from one year to another. It is therefore advisable to keep the records of the *natural yield* of the plots for several years, previous to the application of manures.

With regard to individual yield of trees it has been observed :

1. That a large proportion of the trees give less than 13 pods (or a pound of dry cacao) per annum even in a very favourable year.

2. That although a favourable season considerably reduces the percentage of trees bearing less than a pound of dry cacao per annum the proportion of these, in certain fields may exceed 50 per cent., on an average, whereas in other fields it is less than 15 per cent. It is no doubt for this reason that the yield of certain estates in the Colony is so poor; this may be attributed, at any rate in part, to want of care in the selection of seed for planting.

(1.) *Bull., Dept. Agr.*, XV. 1916, 130-138 and 193-205.

3. That generally the percentage of trees bearing less than 13 pods appears to exert the largest influence on the relative yield of the plots.

4. That the heavy bearing trees of the first year have, generally, continued to be heavy bearers and that the poor bearing trees have remained poor bearers during subsequent years.

From these observations it is obvious that under conditions existing in Trinidad and Tobago it would be absolutely misleading to consider any one plot as a control for any series of plots, and that it is necessary that the *natural* yield of each plot should be ascertained, preferably for several years, previous to the application of the manures or other experimental treatment before a reliable opinion can be arrived at of the value of the manurial treatment given to the plots. For these reasons it has been deemed desirable to alter the form of reporting the results previously recorded. It does not, however, affect the comparisons made in former reports.

In the present series of experiments the *natural* yield of the plots has only been ascertained for Field No. 7, but as indicated below a substitute for the *natural* yield for the other experiments can still be arrived at.

The results obtained, both at River Estate, and on all the private properties where these manurial experiments are being carried out indicate that under normal conditions the manures generally begin to affect the crop a year after their application; the first year's yield may thus be considered as a substitute for the *natural* yield of each plot. In Field No. 1 at River Estate, owing to the severe drought of 1911-12, no effect from manures was visible until after the second year's crop, as can be seen by comparing the yield of the first two years for each plot with that of the control plots for the same period. (1) For this field, therefore the average for the two years 1910-11 and 1911-12 has been taken as the substitute for the *natural* yield and the first year's yield for the plots in all other experiments where the *natural* yield has not been kept.

All the plots have been treated in the same manner as in previous years. The manures were applied broadcast to within three feet of the trunk of each tree, about two feet from the edge of the drains and the soil forked to a depth of about six inches. The control plots were also forked but no manures added. On plots which received basic slag, sulphate of ammonia and sulphate of potash, the sulphates of ammonia and potash were applied two months after the slag.

Throughout this report the age of the trees given is the approximate age during the first year of the experiments. In calculating the results recorded in the various tables it has been assumed that twelve pods produce a pound of dry cacao, and the value of the marketable produce has been raised from eleven to twelve cents (6d.) per pound. It is obvious that the gain or loss resulting from the application of manures will vary in practice with the price of the produce. The higher the price the greater will be the gain and *vice vêrsa.*

(1.) *Bulletin Department Agriculture*, xv. 1916, 114-116.

RAINFALL.

The rainfall for the 12 months from May 1, 1916 to April 30, 1917, was 65·24 inches. It is 11·40 inches less than that of last year but approximately the average of the preceding six years.

The monthly rainfall registered at River Estate and the number of days on which rain fell during the past seven years is given below. The total rainfall for the other estates where experiments are being made is given in the body of the report for each estate respectively.

RAINFALL RIVER ESTATE, 1910–1917.

MONTH.	1910–11.	No. of days rain fell.	1911–12.	No. of days rain fell.	1912–13.	No. of days rain fell.	1913–14.	No. of days rain fell.	1914–15.	No. of days rain fell.	1915–16.	No. of days rain fell.	1916–17.	No. of days rain fell.
May ...	5·38	16	0·55	6	4·09	17	2·32	9	3·85	13	6·01	13	1·32	12
June ...	8·96	21	10·93	27	7·71	24	6·05	19	5·88	19	7·59	23	10·02	19
July ...	8·29	16	8·17	22	12·96	24	5·91	18	8·84	22	13·47	25	6·01	18
August ...	10·72	23	15·35	26	7·79	23	16·10	24	4·74	20	7·05	17	12·06	23
September ...	6·90	20	7·09	20	9·16	21	11·14	22	9·21	20	6·06	21	8·25	21
October ...	6·18	16	4·68	20	4·86	12	4·76	19	9·83	20	8·45	13	7·29	21
November ...	7·39	20	4·32	15	5·45	18	8·20	23	6·03	19	8·39	25	9·37	21
December ...	2·89	12	2·97	13	7·35	22	4·00	14	4·80	22	2·85	19	3·23	18
January ...	2·00	12	0·84	7	3·79	21	0·58	6	1·84	9	6·25	17	3·01	18
February ...	2·98	9	0·53	5	1·64	13	0·96	14	1·04	8	2·74	14	1·79	13
March ...	1·92	6	0·99	8	1·43	15	1·18	10	0·04	2	4·52	19	2·47	8
April ...	1·08	6	0·30	2	0·43	7	1·66	7	4·34	15	3·26	9	0·42	3
	64·69	177	56·72	171	66·66	217	62·86	185	60·44	189	76·64	215	65·24	195

PODS PER LB. OF DRY CACAO.

The cacao reaped from all the plots in Field No. 1 at River Estate, from the plots on the estates referred to below have been dried and weighed separately, with the object of ascertaining the number of pods required to produce a pound of dry cacao. The results for the six years 1911–17 for each estate are as follows :—

River	11·88 pods.	New Grant	13·59 pods.	La Compensacion	11·16 pods.
Brooklyn	11·34 ,,	Perseverance	14·04 ,,	Santa Isabella	10·56 ,,
Sta. Marta	12·31 ,,	Esperanza	12·68 ,,	Soconusco	14·35 ,,

The average result for the above estates for the same period, based on 2,344,708 pods yielding 193,081 pounds of dry cacao, works out at 12·14 pods.

MANURIAL EXPERIMENTS AT RIVER ESTATE.

Field No. 1.—Trees planted 12 feet by 12 feet, about 11 years old in 1910. Manures applied each year from 1910, but no sulphate of potash in 1916.

CONTROL PLOTS.

There are three control plots, A, G, and U, containing 138 bearing trees, to which no manure has been applied. For the two years 1910–12 they gave an average yield of 27·36 pods per tree. In 1916–17 their yield was 40·53, an average increase of 13·17 pods per tree, and during the five years 1912–16, 38·06, or an average increase of 10·70 pods per tree per annum. These figures have been taken as the basis of comparison with the results from plots which have undergone manurial treatment.

ORGANIC MANURES ALONE.

Plot D. 1½ tons Sheep Manure per acre to 52 trees.—Average yield 1910–12 was 28·43 pods per tree and for the five years 1912–17, 42·10 pods; an average increase of 13·67 pods per tree. Deducting 10·70, the increase for the control plots during the same period, leaves 2·97 pods per tree as increase due to manuring. The value of this increase per acre is $8.91, and the cost of manuring $15.33 resulting in a loss on manuring of $6.42 per acre per annum.

Plot E. 20 tons Pen manure per acre to 49 trees.—Average yield 1910–12 was 36·80 pods per tree and for the five years 1912–17, 52·08 pods; an average increase of 15·28 pods per tree. Deducting 10·70, the increase for the control plots during the same period, leaves 4·58 pods per tree as increase due to manuring. The value of this increase per acre is $13.74, and the cost of manuring $26.35 resulting in a loss on manuring of $12·61 per acre per annum.

Plot H. 10 cwt. Bird manure per acre to 44 trees. (1)—Average yield 1910–12 was 28·69 pods per tree and for the five years 1912–17, 41·76 pods; an average increase of 13·07 pods per tree. Deducting 10·70, the increase for the control plots during the same period, leaves 2·37 pods per tree as increase due to manuring. The value of this increase per acre is $7.11, and the cost of manuring $10.91 resulting in a loss on manuring of $3.80 per acre per annum.

Plot O. 25 tons Mulch per acre to 50 trees.—Average yield 1910–12 was 21·50 pods per tree and for the five years 1912–17, 33·37 pods an average increase of 11·87 pods per tree. Deducting 10·70, the increase for the control plots during the same period, leaves 1·17 pods per tree as increase due to manuring. The value of this increase per acre is $3.51 and the cost of manuring $49.22 resulting in a loss on manuring of $45.71 per acre per annum.

Plot V. 10 cwt. Bird manure per acre to 52 trees (1).—Average yield 1910-12 was 39·56 pods per tree and for the five years 1912–17, 42·96 pods; an average increase of 3·40 pods per tree. Deducting 10·70, the increase for the control plots during the same period, leaves a decrease of 7·30 pods per tree. The cost of the manuring was $10.49 per acre per annum.

This plot is subject to thefts and results from it are not reliable.

ARTIFICIAL MANURES ALONE.

Plot R. 1¼ cwt. Sulphate of ammonia and 1¼ cwt. Sulphate of potash per acre to 47 trees.—Average yield 1910–12 was 37·52 pods per tree and for the five years 1912–17, 48·99 pods; an average increase of 11·47 pods per tree. Deducting 10·70, the increase for the control plots during the same period, leaves 0·77 pods per tree as increase due to manuring. The value of this increase per acre is $2.31, and the cost of manuring $8.47 resulting in a loss on manuring of $6.16 per acre per annum.

Plot T. 5 cwt. Basic slag, 1¼ cwt. Sulphate of ammonia and 1¼ cwt. Sulphate of potash per acre to 52 trees.—Average yield 1910–12 was 25·98 pods per tree and for the five years 1912–17, 37·50 pods; an average increase of 11·52 pods per tree. Deducting 10·70, the average increase for the control plots during the same period, leaves 0·82 pods per tree as increase due to manuring. The value of this increase per acre is $2.46, and the cost of manuring $14.14 resulting in a loss on manuring of $11.68 per acre per annum.

MIXED ORGANIC AND ARTIFICIAL MANURES.

Plot B. 15 cwt. Sheep manure, 5 cwt. Bone meal and 1¼ cwt. Sulphate of potash per acre to 51 trees.—Average yield 1910–12 was 18·21 pods per tree and for the five years 1912–17, 32·29 pods; an average increase o 14·08 pods per tree. Deducting 10·70, the increase for the control plots during the same period, leaves 3·38 pods per tree as increase due to manuring. The value of this increase per acre is $10.14, and the cost of manuring $21.72 resulting in a loss on manuring of $11.58 per acre per annum.

Plot C. 15 cwt. Sheep manure, 75 lb. Sulphate of ammonia and 75 lb. Sulphate of potash per acre to 48 trees.—Average yield 1910–12 was 20·65 pods per tree and for the five years 1912–17, 39·20 pods; an average increase of 18·55 pods per tree. Deducting 10·70, the increase for the control plots during the same period, leaves 7·85 pods per tree as increase due to manuring. The value of this increase per acre is $23.55, and the cost of manuring $12.54 resulting in a gain on manuring of $11.01 per acre per annum.

(1.) The plots containing Bird manure are classified under organic manures for convenience, although in reality they contain very little organic matter, being of the nature of a phosphatic guano.

Plot F. 10 tons Pen manure, 5 cwt. Basic slag and 75 lb. Sulphate of potash per acre to 44 trees.—Average yield 1910–12 was 34·07 pods per tree and for the five years 1912–17, 49·79 pods; an average increase of 15·72 pods per tree. Deducting 10·70 the increase for the control plots during the same period, leaves 5·02 pods per tree as increase due to manuring. The value of this increase per acre is $15.06, and the cost of manuring $21.21 resulting in a loss on manuring of $6.15 per acre per annum.

Plot I. 5 cwt. Bird manure, 1¼ cwt. Sulphate of ammonia and 2½ cwt. Sulphate of potash per acre to 48 trees.—Average yield 1910–12 was 34·99 pods per tree and for the five years 1912–17, 56·65 pods; an average increase of 21 66 pods per tree. Deducting 10·70 the increase for the control plots during the same period, leaves 10·96 pods per tree an increase due to manuring. The value of this increase per acre is $32.88 and the cost of manuring $17.72 resulting in a gain on manuring of $15.16 per acre per annum.

Plot J. 5 cwt. Bird manure, 75 lb. Sulphate of ammonia and 1¼ cwt. Sulphate of potash per acre to 45 trees.—Average yield 1910–12 was 29·60 pods per tree and for the five years 1912–17, 46·15 pods; an average increase of 16·55 pods per tree. Deducting 10·70 the increase for the control plots during the same period leaves 5·85 pods per tree as increase due to manuring. The value of this increase per acre is $17.55, and the cost of manuring $11.71 resulting in a gain on manuring of $5.84 per acre per annum.

Plot K. 5 cwt. Bird manure, 5 cwt. Basic slag and 1¼ cwt. Sulphate of potash per acre to 51 trees.—Average yield 1910–12 was 29·19 pods per tree and for the five years 1912–17, 37·75 pods; an average increase of 8·56 pods per tree. Deducting 10·70, the increase for the control plots during the same period, leaves a decrease of 1·14 pods per tree. The cost of manuring was $14.45 per acre per annum.

Plot M. 13 tons Mulch, 5 cwt. Basic slag and 1¼ cwt. Sulphate of potash per acre to 49 trees.—Average yield 1910–12 was 25·57 pods per tree and for the five years 1912–17, 35·03 pods; an average increase of 9·46 pods per tree. Deducting 10·70, the increase for the control plots during the same period, leaves a decrease of 1·24 pods per tree. The cost of manuring was $33.92 per acre per annum.

Plot N. 13 tons Mulch, 2½ cwt. Basic slag, 75 lb. Sulphate of ammonia and 75 lb. Sulphate of potash per acre to 48 trees.—Average yield 1910–12 was 19·25 pods per tree and for the five years 1912–17, 27·99 pods; an average increase of 8·74 pods per tree. Deducting 10·70, the increase for the control plots during the same period, leaves a decrease of 1·96 pods per tree. The cost of manuring was $31.06 per acre per annum.

Plot P. 10 tons Pen manure, 5 cwt. Bone meal, 75 lb. Sulphate of ammonia and 75 lb. Sulphate of potash per acre to 51 trees.—Average yield 1910–12 was 35·10 pods per tree and for the five years 1912–17, 45·53 pods; an average increase of 10·43 pods per tree. Deducting 10·70, the increase for the control plots during the same period, leaves a decrease of 0·27 pods per tree. The cost of manuring was $28.00 per acre per annum.

Plot Q. 10 tons Pen manure, 75 lb. Sulphate of ammonia and 1¼ cwt. Sulphate of potash per acre to 42 trees.—Average yield 1910-12 was 44·50 pods per tree and for the five years 1912-17, 61·80 pods; an average increase of 17·30 pods per tree. Deducting 10·70, the increase for the control plots during the same period, leaves 6·60 pods per tree as increase due to manuring. The value of this increase per acre is $19.30, and the cost of manuring $19.50 resulting in a gain on manuring of $0.30 per acre per annum.

Plot S. 10 cwt. Bone meal, 1¼ cwt. Sulphate of ammonia and 1¼ cwt. Sulphate of potash per acre to 46 trees.—Average yield 1910-12 was 23·66 pods per tree and for the five years 1912-17, 42·67 pods; an average increase of 19·01 pods per tree. Deducting 10·70, the increase for the control plots during the same period, leaves 8·31 pods per tree as increase due to manuring. The value of this increase per acre is $24.93, and the cost of manuring $29.03 resulting in a loss on manuring of $4.10 per acre per annum.

LIME ALONE.

Plot L. 10 cwt. Lime per acre to 48 trees.—Average yield 1910-12 was 14·38 pods per tree and for the five years 1912-17, 19·58 pods; an average increase of 5·20 pods per tree. Deducting 10·70, the increase for the control plots during the same period, leaves a decrease of 5·50 pods per tree. The cost of manuring was $4.32 per acre per annum.

Plot W. 5 cwt. Lime per acre to 51 trees.—Average yield 1910-12 was 38·63 pods per tree and for the five years 1912-17, 33·80 pods; an average decrease of 4·83 pods per tree. To this decrease add 10·70, the increase for the control plots during the same period, it gives a total decrease of 15·53 pods per tree. The cost of manuring was $2.32 per acre per annum.

This plot is also subject to thefts and results from it are not reliable.

Field No. 6.—Trees planted 14 feet by 14 feet, about 25 to 30 years old in 1910. Manures applied each year from 1910, but no sulphate of potash in 1916.

CONTROL PLOT.

There is one control plot in this set of experiments containing 398 bearing trees. For 1910-11 it gave a yield of 9·80 pods per tree. In 1916-17, its yield was 19·00 an average increase of 9·20 pods per tree and during the six years 1911-17, 10·09, or an average increase of 0·29 pods per tree per annum.

ORGANIC MANURES ALONE.

Plot 1. 17 cwt. Sheep manure per acre to 925 trees.—The yield in 1910-11 was 16·80 pods per tree and for the six years 1911-17, 19·00 pods; an average increase of 2·20 pods per tree. Deducting 0·29, the increase from the control plot during the same period, leaves 1·91 pods per tree as increase due to manuring. The value of this increase per acre is $4.20 and the cost of manuring $9.47 resulting in a loss on manuring of $5.27 per acre per annum.

Plot 2. 8 cwt. Bird manure to 547 trees.—The yield in 1910-11 was 31·10 pods per tree and for the six years 1911-17, 27·83 pods; an average decrease of 3·27 pods per tree. To this decrease add 0·29 the increase from the control plot during the same period, it gives a total decrease of 3·56 pods per tree. The cost of manuring was $9.07 per acre per annum.

Plot 3. 8 cwt. Sheep and 8 cwt. Bird manure per acre to 520 trees.—The yield in 1910-11 was 28·80 pods per tree and for the six years 1911-17, 32·03 pods; an average increase of 3·23 pods per tree. Deducting 0·29, the increase for the control plot during the same period, leaves 2·94 pods per tree as increase due to manuring. The value of this increase per acre is $6.47, and the cost of manuring $13.50 resulting in a loss on manuring of $7.03 per acre per annum.

Plot 4. 20 tons Mulch per acre to 185 trees.--The yield in 1910-11 was 30·10 pods per tree and for the six years 1911-17, 39·30 pods; an average increase of 9·20 pods per tree. Deducting 0·29, the increase for the control plot during the same period, leaves 8·91 pods per tree as increase due to manuring. The value of this increase per acre is $19.60, and the cost of manuring $27.17 resulting in a loss on manuring of $7.57 per acre per annum.

Plot 7. 15 tons pen manure per acre to 1,116 trees.—The yield in 1910-11 was 41·30 pods per tree and for the six years 1911-17, 47·85 pods; an average increase of 6·55 pods per tree. Deducting 0·29, the increase for the control plot during the same period, leaves 6·26 pods per tree as increase due to manuring. The value of this increase per acre is $13.77, and the cost of manuring $33.82 resulting in a loss on manuring of $20.05 per acre per annum.

ARTIFICIAL MANURES ALONE.

Plot 6. 8 cwt. Basic slag and 2 cwt. Sulphate of potash to 272 trees (1).—The yield in 1910-11 was 41·40 pods per tree and for the six years 1911-17, 47·41 pods; an average increase of 6·01 pods per tree. Deducting 0·29, the increase for the control plot during the same period, leaves 5·72 pods per tree as increase due to manuring. The value of this increase per acre is $12.58, and the cost of manuring $17.43 resulting in a loss on manuring of $4.85 per acre per annum.

Plot 8. 8 cwt. Basic slag, 65 lb. Sulphate of ammonia and 1 cwt. Sulphate of potash to 493 trees. The yield in 1910-11 was 19·90 pods per tree and for the six years 1911-17, 36·85 pods; an average increase of 16·95 pods per tree. Deducting 0·29, the increase for the control plot during the same period, leaves 16·66 pods per tree as increase due to manuring. The value of this increase per acre is $36.65, and the cost of manuring $12.78 resulting in a gain on manuring of $23.87 per acre per annum.

MIXED ORGANIC AND ARTIFICIAL MANURES.

Plot 5. 8 cwt. Bone meal, 1 cwt. Sulphate of ammonia and 1 cwt. Sulphate of potash to 276 trees (1). The yield in 1910-11 was 38·30 pods per tree and for the six years 1911-17, 46·78 pods; an average increase of 8·48 pods per tree. Deducting 0·29, the increase for the control plots

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(1.) This plot also received an application of mulch, at the rate of 20 tons per acre, in 1910, but it was discontinued owing to the difficulty of obtaining mulching material.

during the same period, leaves 8·19 pods per tree as increase due to manuring. The value of this increase per acre is $18.02, and the cost of manuring $23.43 resulting in a loss on manuring of $5.41 per acre per annum.

EXPERIMENT WITH OHLENDORFF'S CACAO MANURE.

Field No. 9. Trees planted 12 feet by 12 feet, 9 to 10 years old in 1911. Manures applied each year from 1911 to 1915. No manure was applied in 1916 owing to its excessive cost.

Control plot. There is one control, plot 2, containing 387 bearing trees to which no manure was applied; it is situated between the two manured plots. In 1911-12 the yield was 11·87 pods per tree and for the average of the five years 1912-17, 22·82 pods, an average increase of 10·95 pods per tree per annum.

Plot 1. 8 cwt. Ohlendorff's cacao manure per acre to 376 trees. The yield in 1911-12 was 19·59 pods per tree and for the five years 1912-17, 36·91 pods; an average increase of 17·32 pods per tree. Deducting 10·95 the increase for the control plot during the same period, leaves 6·37 pods per tree as increase due to manuring. The value of this increase per acre is $19·11, and the cost of manuring $17.52 resulting in a gain on manuring of $1·59 per acre per annum.

Plot 3. 5 cwt. Ohlendorff's cacao manure per acre to 393 trees. The yield in 1911-12 was 16·43 pods per tree and for the five years 1912-17, 35·65 pods; an average increase of 19·22 pods per tree. Deducting 10·95 the increase for the control plot during the same period, leaves 8·27 pods per tree as increase due to manuring. The value of this increase per acre is $24.81, and the cost of manuring $11.80 resulting in a gain on manuring of $13.01 per acre per annum.

EXPERIMENT WITH BASIC SLAG AND LIME.

Field No. 7. Trees planted 12 feet by 12 feet, 10 to 12 years old in 1911. Yields were recorded from all plots for 2 years, 1911-13, without any manuring at all. Manures were applied each year from 1913, but no sulphate of potash in 1916. Assuming, as in other cases, that the manures had no effect on the first year's crop, the yield of each plot for 3 years 1911-14 has been taken as the *natural* yield.

Control plot. There is one control plot containing 43 bearing trees. The average yield for 1911-14 was 44·40 pods per tree and for the three years 1914-17, 46·24 pods; an average increase of 1·84 pods per tree per annum.

Plot 8.—500 lb. basic slag, 200 lb. sulphate of ammonia and 80lb. sulphate of potash per acre to 43 trees.—Average yield 1911–14 was 37·63 pods per tree and for the three years 1914–17, 48·61 pods; an average increase of 10·98 pods per tree. Deducting 1·84, the increase for the control plot during the same period, leaves 9·14 pods per tree as increase due to manuring. The value of this increase per acre is $27.42, and the cost of manuring $14.47 resulting in a gain on manuring of $12.95 per acre per annum.

Plot 9.—500 lb. lime, 200 lb. Sulphate of ammonia and 80 lb. Sulphate of potash per acre to 48 trees.—Average yield 1911–14 was 39·44 pods per tree and for the three years 1914–17, 41·71 pods; an average increase of 2·27 pods per tree. Deducting 1·84, the increase for the control plot during the same period, leaves 0·43 pods per tree as increase due to manuring. The value of this increase per acre is $1.29, and the cost of manuring $11.51 resulting in a loss on manuring of $10.22 per acre per annum.

SHADE AND NO SHADE EXPERIMENTS.

The shade experiments are being made in Fields 5 and 10. In Field 5 the trees are planted 15 feet by 15 feet and they were about 25 to 30 years old in 1910. There are three plots as follows :—

The *Full shade* plot A, containing 483 bearing cacao trees, with the usual number of Immortel (*Erythrina* spp.) shade trees *i.e.* about 120.

The *No shade* plot B, containing 478 bearing cacao trees from which 49 bocare immortel were cut out and 129 anauco trees barked in July and August 1910.

The *Partial shade* plot C, containing 494 bearing cacao trees and about 60 immortel trees more or less evenly distributed over the plot.

A large amount of damage was caused by the falling of the barked immortel trees during 1911 and 1912 resulting in a decrease of the crop from both the partial and no shade plots during 1912–13. These plots also appear to have suffered to a greater extent from the drought than the full shade plot A. On the other hand a partial mulch and organic matter has been added to the land in the partial and no shade plots from cutting up the immortel trees and from their decomposition. The advantages gained on the one hand and the disadvantages suffered on the other have probably disappeared and it will be interesting to compare the yield of the first 5 years with that of subsequent years. The results are tabulated below :—

AVERAGE NUMBER OF PODS PICKED PER ACRE.

	Field 5. Trees planted 15 ft. x 15 ft. 25 to 30 years in 1910.			Field 10. Trees planted 12 ft. x 12 ft. 7 to 10 years in 1910.	
Year.	A. Full Shade.	B. No Shade.	C. Partial Shade.	I. No Shade.	J. Full Shade.
1910–11 ...	9,105	11,575	10,179	2,715	5,912
1911–12 ...	8,666	10,393	10,453	2,402	4,767
1912–13 ...	9,083	8,446	9,012	3,609	5,121
1913–14 ...	9,839	11,284	11,794	4,612	6,780
1914–15 ...	7,608	7,676	9,675	4,266	6,951
5 Years Average.	8,863	9,889	10,222	3,492	5,841
1915–16 ...	9,905	8,502	10,304	3,690	6,435
1916–17 ...	9,781	11,324	12,437	8,385	8,094

In Field 10 there are only two plots a *no shade* and a *full shade* plot.

The *no shade* plot I contains 1,979 bearing trees, planted 12 feet by 12 feet, approximately 7 to 8 years old in 1910. All of the immortel trees were completely cut out in October and November 1910. Banana suckers were planted in the open patches in January 1911, so as to protect the land from the direct action of the sun. No damage was done to the cacao trees in this plot by the felling of the immortel trees as they were comparatively small. The cacao trees in this and the no shade plot B, in Field 5, are more susceptible to attacks of the cacao beetle (*Steirastoma depressum* L.) and Thrips (*Heliothrips rubrocinctus*, Giard.) than those in the shaded plot.

The *full shade* plot J contains 1,957 bearing trees, planted 12 feet by 12 feet, approximately 9 to 10 years old in 1910. The immortel shade trees are fairly regularly planted, at 24 feet apart, the yield for the past seven years are given in the table above.

CHUPON EXPERIMENTS.

The chupon experiments are being made in Field 8 and their object, as stated in previous reports, is to ascertain in what way the yield will be affected by allowing all, some, or no chupons to grow. Under the conditions at River few, if any, chupons have grown above the fork of the tree.

The experiments are being made in duplicate: that is with trees planted 12 feet by 12 feet, 7 to 9 years old in 1910 and with trees planted 15 feet by 15 feet, 25 to 30 years old in 1910.

It is generally admitted in this Island that chupons begin to affect the yield of cacao trees on which they are allowed to grow, after the fourth or fifth year. Accordingly, interesting information may be obtained by comparing the average yield of the first five years with that of subsequent years.

The results obtained during the past seven years are given below:—

AVERAGE NUMBER OF PODS PICKED PER ACRE.

Field 8.—Trees planted 12 feet by 12 feet—9 to 10 years in 1910.

YEAR.	D. All Chupons.	E. 3 Chupons.	F. 2 Chupons.	G. 1 Chupon.	H. No Chupons.
1910–11 ...	8,892	7,512	8,025	11,061	10,461
1911–12 ...	9,702	12,132	12,479	13,842	13,215
1912–13 ...	8,640	11,197	12,206	11,318	12,753
1913–14 ...	11,184	13,028	12,970	13,354	13,179
1914–15 ...	10,416	11,829	11,898	12,300	12,060
5 years average ...	9,768	11,124	11,505	12,375	12,333
1915–16 ...	11,104	11,943	11,169	11,766	11,754
1916–17 ..	12,684	13,551	13,881	13,476	13,110

AVERAGE NUMBER OF PODS PICKED PER ACRE.

Field 8.—Trees planted 15 feet by 15 feet—25 to 30 years in 1910.

	D.D. All Chupons	E.E. 3 Chupons.	F.F. 2 Chupons.	G.G. 1 Chupon.	H.H. No Chupons.
1910–11 ...	10,898	8,860	7,921	8,290	10,613
1911–12 ...	14,248	12,274	9,448	10,876	14,670
1912–13 ...	12,486	11,108	7,838	11,148	12,899
1913–14 ...	12,548	12,525	8,360	11,956	14,157
1914–15 ...	12,745	12,967	9,667	14,229	13,372
5 years average ...	12,584	11,541	8,645	11,257	13,140
1915–16 ..	12,929	12,669	9,745	14,672	15,208
1916–17 ...	14,729	13,684	9,511	14,077	14,753

EXPERIMENTS ON PRIVATE ESTATES.

Manurial experiments have also been carried out on ten private estates situated in different parts of the Colony. Manures were applied each year from 1911; but no sulphate of potash in 1916.

Santa Marta Estate, Tamana.—The land is hilly; the soil a heavy clay containing a large amount of lime; elevation about 300 feet; average rainfall for the past six years 96·52 inches. The trees are planted 12 feet by 12 feet, 25 to 30 years old in 1911, irregularly shaded with the bocare immortel (*Erythrina velutina*). There are two control plots, Nos. 4 and 8, containing 195 bearing trees. In June 1914, the whole field was dynamited with the exception of control plot 4. The average yield from control plot 8 for the three years ending August 31, 1914, (*i.e.* previous to dynamiting) was 9·21 pods per tree, and for the three years to August 31, 1917 (*i.e.* subsequent to dynamiting) was 6·84 pods per tree, a decrease of 2·37 pods per tree. The average yield from control plot 4, which was not dynamited, for the same periods was 9·46 and 5·51 pods per tree respectively, a decrease of 3·95 pods per tree. Control plot 8 has therefore possibly benefitted from the effects of the dynamite to the extent of 1·58 pods per tree, or $2.13 per acre per annum for the past 3 years. The total cost of dynamiting was $37.60 per acre. The benefit derived from dynamiting is apparently so small that in calculating the results of the manurial experiments, the average of plots 4 and 8 has been taken as the control plot. In 1911–12, these control plots gave an average yield of 5·76 pods per tree and during the 5 years 1912–17, 8·14 pods, an average increase of 2·38 pods per tree per annum. It should be mentioned that the field under experiment is the field giving the poorest yield on the estate, and was specially selected on that account.

New Grant Estate, Princes Town.—The land is undulating; elevation about 250 feet; soil a heavy clay containing a large proportion of lime. The average rainfall for the past 6 years has been 68·70 inches. The trees are planted 12 feet by 12 feet, 11 years old in 1911 and regularly shaded with bocare immortel. There are two control plots, containing 219 bearing trees. In 1911–12, they gave an average yield of 17·47 pods per tree and during the 5 years 1912–17, 27·85 pods, an average increase of 10·38 pods per tree per annum, which is attributed chiefly to the increasing age of the trees. Although most of the manured plots have given a larger increase than the control plots, the additional increase due to manuring has not been sufficiently large to pay for the cost of manuring.

Santa Teresa Estate, Cumuto.—Flat Vega or Valley land; soil a heavy clay; elevation about 200 feet. The average rainfall in the district for the past 6 years has been 85·33 inches. The trees are planted 12 feet by 12 feet, 40 to 45 years old in 1911 and fairly regularly shaded with bocare immortel. There are two control plots containing 342 bearing trees. In 1911–12, they gave an average yield of 12·78 pods per tree and during the 5 years 1912–17, 15·98 pods, an average increase of 3·20 pods per tree per annum.

Perseverance Estate, Talparo.—Vega land; soil a heavy clay; elevation about 150 feet. The average rainfall for the past 6 years has been 80·24 inches. The trees are planted 12 feet by 12 feet, 35 to 40 years old in 1911 and fairly regularly shaded with bucare immortel. There are three control plots containing 435 bearing trees. In 1911–12, they gave an average yield of 22·86 pods per tree and during the 5 years 1912–17, 27·26 pods, an average increase of 4·40 pods per tree per annum.

Esperanza Estate, California.—The land is flat; soil a heavy clay; elevation about 25 feet. The average rainfall for the past 6 years has been 52·74 inches. The trees are planted 14 feet by 12 feet, 9 to 10 years old in 1911 and regularly shaded with bucare immortel. There are 3 control plots containing 323 bearing trees. In 1911-12 they gave an average yield of 13·56 pods per tree and during the 5 years 1912-17, 13·20 pods, an average decrease of 0·36 pods per tree per annum. Owing to the age of the trees, the decrease in the yield of these plots is quite unexpected and is attributed to the very low rainfall of 1911-15, 50 inches. During the past 2 years the rainfall has been more satisfactory and there has been an increase of 2·97 pods per tree per annum.

La Compensacion Estate, Arima.—Flat vega land; soil a clay loam; elevation about 100 feet. The average rainfall for the past 6 years has been 75·43 inches. The trees are planted 12 feet by 12 feet, over 50 years old in 1911 and are fairly regularly shaded with bucare immortel. There are two control plots, containing 302 bearing trees. In 1911-12, they gave an average yield of 14·15 pods per tree and during the 5 years 1912-17, 20·37 pods, an average increase of 6·22 pods per tree per annum.

Santa Isabella Estate, Brasso.—Slightly undulating land; loam soil; elevation about 200 feet. The average rainfall on an adjoining estate for the past 6 years has been 75·93 inches. The trees are planted 13 feet by 13 feet, 25 to 30 years old in 1911 and are fairly regularly shaded with anauco immortel. There are 3 control plots containing 325 bearing trees.

In 1911-12, they gave an average yield of 26·62 pods per tree and during the 5 years 1912-17, 30·67 pods, an average increase of 4·05 pods per tree per annum.

Soconusco Estate, Santa Cruz.—Flat land situated in the Santa Cruz valley; soil a sandy loam; elevation about 150 feet. The average rainfall in the district for the past 6 years has been 67·63 inches. The trees are planted 12 feet by 12 feet, over 50 years old in 1911 and are fairly regularly shaded with anauco immortel. There are 2 control plots containing 244 bearing trees. In 1911-12, they gave an average yield of 29·68 pods per tree, and during the 5 years 1912-17, 24·85 pods, an average decrease of 4·83 pods per tree per annum.

Brooklyn Estate, Sangre Grande.—Flat land, situated practically at the junction of the Sangre Grande and Cunapo Rivers; soil deep loam. The average rainfall in the district for the past 6 years has been 90·32 inches. The trees are planted 13 feet by 13 feet, 18 to 20 years old in 1911 and regularly shaded with bucare immortel. There are 4 control plots containing 1,237 bearing trees. In 1911–12, they gave an average yield of 17·60 pods per tree and during the 5 years 1912-17, 20·80 pods, an average increase of 3·20 pods per tree per annum.

Richmond Estate, Tobago.—Flat land; soil a heavy clay. The cacao trees are planted 12 feet by 12 feet, 12 years old in 1911, shaded with Castilloa rubber and bocare immortel trees alternately 24 feet apart. The average rainfall in the district for the past 6 years has been 87·58 inches. There is one control plot containing 81 bearing trees. In 1911–12 it gave an average yield of 26·08 pods per tree and during the 5 years 1912-17, 29·53 pods, an average increase of 3·45 pods per tree per annum.

The average results obtained from the above estates during the past 5 years (1912–17) are as follows:—

ORGANIC MANURES ALONE.

12 tons Mulch per acre.

Soconusco Estate.—Average yearly increase on the control plots, for the 5 years 1912–17, is 8·01 pods per tree. The value of this increase is $24.03 and the cost of manuring $28.03 resulting in a loss on manuring of $4.00 per acre per annum.

7 tons Pen manure per acre.

Soconusco Estate.—This plot has given an average yearly decrease on the control plots, for the 5 years 1912–17, of 6·05 pods per tree. The cost of manuring was $12.89 per acre per annum.

10 tons Pen manure per acre.

Richmond Estate.—Average yearly increase on the control plot, for the 5 years 1912–17, is 2·07 pods per tree. The value of this increase is $6.21 and the cost of manuring $18.61 resulting in a loss on manuring of $12 40 per acre per annum.

15 tons Pen manure per acre.

Brooklyn Estate.—This plot has given an average yearly decrease on the control plots, for the 5 years 1912–17, of 2·89 pods per tree and the cost of manuring was $21.03 per acre per annum.

MIXED ORGANIC AND ARTIFICIAL MANURES.

5 cwt. Bone meal and 2½ cwt. Nitrate of soda per acre.

Santa Teresa Estate.—Average yearly increase on the control plots for the 5 years 1912-17, is 1·69 pods per tree. The value of this increase is $5.07 and the cost of manuring $19.32 resulting in a loss on manuring of $14.25 per acre per annum.

Perseverance Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 1·49 pods per tree. The value of this increase is $4.47 and the cost of manuring $18.71 resulting in a loss on manuring of $14.24 per acre per annum.

5 cwt. Bone meal and 2½ cwt. Calcium nitrate per acre.

Santa Teresa Estate.—Average yearly increase on the control plots, for the 5 years 1912–17, is 2·31 pods per tree. The value of this increase is $6.93 and the cost of manuring $19.18 resulting in a loss on manuring of $12.25 per acre per annum.

5 cwt. Bone meal and 2½ cwt. Calcium cyanamide per acre.

Perseverance Estate.—This plot has given an average yearly decrease on the control plots, for the 5 years 1912-17, of 0·65 pods per tree. The cost of manuring was $18·94 per acre per annum.

2½ cwt. Bone meal, 75 lb. Sulphate of ammonia and 75 lb. Sulphate of potash per acre.

New Grant Estate.—Average yearly increase on the control plots for the 5 years 1912-17, is 1·64 pods per tree. The value of this increase is $4.92 and the cost of manuring $10.95 resulting in a loss on manuring of $6.03 per acre per annum.

2½ cwt. Bone meal, 2½ cwt. Dissolved bones, 1¼ cwt. Nitrate of soda and 75 lb. Sulphate of potash per acre.

Santa Teresa Estate.—This plot has given an average yearly decrease on the control plots, for the 5 years 1912-17, of 1·14 pods per tree. The cost of manuring was $16.33 per acre per annum.

Perseverance Estate.—This plot has given an average yearly decrease on the control plots for the 5 years 1912-17, of 1·09 pods per tree. The cost of manuring was $15·71 per acre per annum.

5 cwt. Bone meal, 75 lb. Sulphate of ammonia and 1½ cwt. Sulphate of potash per acre.

Santa Marta Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 1·47 pods per tree. The value of this increase is $4.41 and the cost of manuring $16.33 resulting in a loss on manuring of $11.92 per acre per annum.

New Grant Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 0·59 pods per tree. The value of this increase is $1.77 and the cost of manuring $17.58 resulting on a loss on manuring of $15.81 per acre per annum.

Esperanza Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 4·27 pods per tree. The value of this increase is $11·02 and the cost of manuring $13.99 resulting in a loss on manuring of $2.97 per acre per annum.

La Compensacion Estate.—Average yearly increase on control plots, for the 5 years 1912-17, is 0·15 pods per tree. The value of this increase is $0.45 and the cost of manuring $16.02 resulting in a loss on manuring of $15.57 per acre per annum.

Santa Isabella Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 10·27 pods per tree. The value of this increase is $26.50 and the cost of manuring $14.94 resulting in a gain on manuring of $11.56 per acre per annum.

Soconusco Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 8·15 pods per tree. The value of this increase is $24.45 and the cost of manuring $17.48 resulting in a gain on manuring of $6.97 per acre per annum.

5 cwt. Bone meal, 1¼ Sulphate of ammonia and 1¼ cwt. Sulphate of potash per acre.

Brooklyn Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 0·49 pods per tree. The value of this increase is $1.26 and the cost of manuring $16.42 resulting in a loss on manuring of $15.16 per acre per annum.

5 cwt. Bone meal, 2½ cwt. Sulphate of ammonia and 1¼ cwt. Sulphate of potash per acre.

Richmond Estate.—This plot has given an average yearly decrease on the control plot, for the 5 years 1912-17, of 3·68 pods per tree and the cost of manuring was $20.85 per acre per annum.

10 tons Pen manure, 2½ cwt. Bone meal, 75 lb. Sulphate of ammonia and 75 lb. Sulphate of potash per acre.

Santa Marta Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 4·24 pods per tree. The value of this increase is $12.72 and the cost of manuring $32.39 resulting in a loss on manuring of $19.67 per acre per annum.

Esperanza Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 1·23 pods per tree. The value of this increase is $3.17 and the cost of manuring $17.16 resulting in a loss on manuring of $13.99 per acre per annum.

La Compensacion Estate.—This plot has given an average yearly decrease on the control plots, for the 5 years 1912-17, of 0·43 pods per tree. The cost of manuring was $24.08 per acre per annum.

Santa Isabella Estate.—Average yearly increase on the control plots for the 5 years 1912-17, is 5·80 pods per tree. The value of this increase is $14.96 and the cost of manuring $28.03 resulting in a loss on manuring of $13.07 per acre per annum.

Soconusco Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 10·57 pods per tree. The value of this increase is $31.71 and the cost of manuring $28.98 resulting in a gain on manuring of $2.73 per acre per annum.

10 tons Pen manure, 75 lb. Sulphate of ammonia and 75 lb. Sulphate of potash per acre.

Santa Marta Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 2·44 pods per tree. The value of this increase is $7.32 and the cost of manuring $27.19 resulting in a loss on manuring of $19.87 per acre per annum.

Esperanza Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 6·93 pods per tree. The value of this increase is $17.88 and the cost of manuring $12.90 resulting in a gain on manuring of $4.98 per acre per annum.

La Compensacion Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 1·38 pods per tree. The value of this increase is $4.14 and the cost of manuring $18.63 resulting in a loss on manuring of $14.49 per acre per annum.

Soconusco Estate.—This plot has given an average yearly decrease on the control plots, for the 5 years 1912-17, of 4·67 pods per tree. The cost of manuring was $24.44 per acre per annum.

5 tons Mulch, 75 lb. Sulphate of ammonia and 75 lb. Sulphate of potash per acre.

Santa Isabella Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 7·12 pods per tree. The value of this increase is $18.37 and the cost of manuring $20.80 resulting in a loss on manuring of $2.43 per acre per annum.

13 tons Mulch, 2½ cwt. Sulphate of ammonia and 1¼ cwt. Sulphate of potash per acre.

Richmond Estate.—Average yearly increase on the control plot, for the 5 years 1912-17, is 5·48 pods per tree. The value of this increase is $16.44 and the cost of manuring $34.71 resulting in a loss on manuring of $18.27 per acre per annum.

13 cwt. Sheep manure and 5 cwt. Dissolved bones per acre.

Brooklyn Estate.—This plot has given an average yearly decrease on the control plots, for the 5 years 1912-17, of 2·79 pods per tree and the cost of manuring was $14.24 per acre per annum.

13 cwt. Sheep manure, 5 cwt. Dissolved bones and 1¼ cwt. Sulphate of potash per acre.

Brooklyn Estate.—This plot has given an average yearly decrease on the control plots, for the 5 years 1912-17, of 1·44 pods per tree and the cost of manuring was $16·76 per acre per annum.

13 cwt. Sheep manure, 10 cwt. Basic slag and 1¼ cwt. Sulphate of potash per acre.

Brooklyn Estate.—This plot has given an average yearly decrease on the control plots, for the 5 years 1912-17, of 1·08 pods per tree and the cost of manuring was $18.67 per acre per annum.

ARTIFICIAL MANURES ALONE.

75 lb. Sulphate of ammonia and 75 lb. Sulphate of potash per acre.

New Grant Estate.—This plot has given an average yearly decrease on the control plots, for the 5 years 1912-17, of 4·07 pods per tree. The cost of manuring was $6.18 per acre per annum

1¼ cwt. Sulphate of ammonia and 1¼ cwt. Sulphate of potash per acre.

Santa Marta Estate.—Average yearly increase on the control plots for the 5 years 1912–17, is 1·16 pods per tree. The value of this increase is $3.48 and the cost of manuring $8.54 resulting in a loss on manuring of $5·06 per acre per annum.

New Grant Estate.—This plot has given an average yearly decrease on the control plots, for the 5 years 1912–17, of 1·85 pods per tree. The cost of manuring was $10.18 per acre per annum.

Esperanza Estate.—Average yearly increase on the control plots for the 5 years 1912–17, is 3·72 pods per tree. The value of this increase is $9.60 and the cost of manuring $7.30 resulting in a gain on manuring of $2.30 per acre per annum.

La Compensacion Estate.—Average yearly increase on the control plots, for the 5 years 1912–17, is 9·30 pods per tree. The value of this increase is $27.90 and the cost of manuring $8.23 resulting in a gain on manuring of $19.67 per acre per annum.

Santa Isabella Estate.—This plot has given an average yearly decrease on the control plots, for the 5 years 1912–17, of 0·71 pods per tree. The cost of manuring was $7·81 per acre per annum.

Soconusco Estate.—Average yearly increase on the control plots, for the 5 years 1912–17 is 3·44 pods per tree. The value of this increase is $10.32 and the cost of manuring $9.71 resulting in a gain on manuring of $0.61 per acre per annum.

5 cwt. Basic slag and 2½ cwt. Nitrate of soda per acre.

Santa Marta Estate.—This plot has given an average yearly decrease on the control plots, for the 5 years 1912-17, of 1·25 pods per tree. The cost of manuring was $13.82 per acre per annum.

New Grant Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 4·40 pods per tree. The value of this increase is $13.20 and the cost of manuring $16.18 resulting in a loss on manuring of $2.98 per acre per annum.

Esperanza Estate.—This plot has given an average yearly decrease on the control plots, for the 5 years 1912-17, of 1·74 pods per tree. The cost of manuring was $11.77 per acre per annum.

La Compensacion Estate.—This plot has given an average yearly decrease on the control plots, for the 5 years 1912-17, of 0·58 pods per tree. The cost of manuring was $13.48 per acre per annum.

Santa Isabella Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 8·84 pods per tree. The value of this increase is $22.81 and the cost of manuring $12.47 resulting in a gain on manuring of $10.34 per acre per annum.

Soconusco Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 8·32 pods per tree The value of this increase is $24.96 and the cost of manuring $14.93 resulting in a gain on manuring of $10.03 per acre per annum

5 cwt. Basic slag and 1¼ cwt. Sulphate of potash per acre.

Santa Marta Estate.—Average yearly increase on the control plots for the 5 years 1912-17, is 7·81 pods per tree. The value of this increase is $23.43 and the cost of manuring $9.07 resulting in a gain on manuring of $14.36 per acre per annum.

New Grant Estate.—This plot has given an average yearly decrease on the control plots, for the 5 years 1912–17, of 3·02 pods per tree. The cost of manuring was $10.69 per acre per annum.

Santa Teresa Estate.—This plot has given an average yearly decrease on the control plots, for the 5 years 1912–17, of 0·70 pods per tree. The cost of manuring was $9.68 per acre per annum.

Perseverance Estate.—Average yearly increase on the control plots, for the 5 years 1912–17, is 1·69 pods per tree. The value of this increase is $5.07 and the cost of manuring $9.03 resulting in a loss on manuring of $3.96 per acre per annum.

Esperanza Estate.—Average yearly increase on the control plots, for the 5 years 1912–17, is 1·14 pods per tree. The value of this increase is $2.94 and the cost of manuring $7.71 resulting in a loss on manuring of $4.77 per acre per annum.

La Compensacion Estate.—Average yearly increase on the control plots, for the 5 years 1912–17, is 1·63 pods per tree. The value of this increase is $4.89 and the cost of manuring $8.75 resulting in a loss on manuring of $3.86 per acre per annum.

Santa Isabella Estate.—Average yearly increase on the control plots, for the 5 years 1912–17, is 6·89 pods per tree. The value of this increase is $17.78 and the cost of manuring $8.39 resulting in a gain on manuring of $9.39 per acre per annum.

Soconusco Estate.—Average yearly increase on the control plots, for the 5 years 1912–17, is 2·50 pods per tree. The value of this increase is $7.50 and the cost of manuring $10.20 resulting in a loss on manuring of $2.70 per acre per annum.

Richmond Estate.—Average yearly increase on the control plot, for the 5 years 1912-17, is 3·30 pods per tree. The value of this increase is $9.90 and the cost of manuring $8.42 resulting in a gain on manuring of $1.48 per acre per annum.

10 cwt. Basic slag and 2½ cwt. Sulphate of potash per acre.

Brooklyn Estate.—This plot has given an average yearly decrease on the control plots, for the five years 1912-17, of 0·39 pods per tree and the cost of manuring was $15.71 per acre per annum.

5 cwt. Basic slag, 1¼ cwt. Sulphate of ammonia and 1¼ cwt. Sulphate of potash per acre.

Santa Marta Estate.—Average yearly increase on the control plots, for the five years 1912–17, is 5·87 pods per tree. The value of this increase is $17.61 and the cost of manuring $13.90 resulting in a gain on manuring of $3.71 per acre per annum.

New Grant Estate.—Average yearly increase on the control plots, for the 5 years 1912–17, is 1·78 pods per tree. The value of this increase is $5.34 and the cost of manuring $15.99 resulting in a loss on manuring of $10·35 per acre per annum.

Santa Teresa Estate.—This plot has given an average yearly decrease on the control plots, for the 5 years 1912-17, of 3·56 pods per tree. The cost of manuring was $14.45 per acre per annum.

Perseverance Estate.—Average yearly increase on the control plots, for the 5 years 1912–17, is 1·54 pods per tree. The value of this increase is $4.62 and the cost of manuring $13.93 resulting in a loss on manuring of $9.31 per acre per annum.

Esperanza Estate.— Average yearly increase on the control plots, for the 5 years 1912–17, is 1·93 pods per tree. The value of this increase is $4.98 and the cost of manuring $11.75 resulting in a loss on manuring of $6.77 per acre per annum.

La Compensacion Estate.—Average yearly increase on the control plots, for the 5 years 1912–17, is 1·52 pods per tree. The value of this increase is $4.56 and the cost of manuring $13.38 resulting in a loss on manuring of $8.82 per acre per annum.

Santa Isabella Estate.—Average yearly increase on the control plots, for the 5 years 1912–17, is 5·09 pods per tree. The value of this increase is $13.13 and the cost of manuring $12.25 resulting in a gain on manuring of $0.88 per acre per annum.

Soconusco Estate.—Average yearly increase on the control plots, for the 5 years 1912–17, is 12·75 pods per tree. The value of this increase is $38.25 and the cost of manuring $15.13 resulting in a gain on manuring of $23.12 per acre per annum.

2½ cwt. Dissolved bones, 1¼ cwt. Nitrate of soda and 1¼ cwt. Sulphate of potash per acre.

Santa Marta Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 2·48 pods per tree. The value of this increase is $7.44 and the cost of manuring $12.28 resulting in a loss on manuring of $4.84 per acre per annum.

New Grant Estate.—This plot has given an average yearly decrease on the control plots, for the 5 years 1912-17, of 0·48 pods per tree. The cost of manuring was $13.57 per acre per annum.

Esperanza Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 1·47 pods per tree. The value of this increase is $3.79 and the cost of manuring $10.53 resulting in a loss on manuring of $6.74 per acre per annum.

La Compensacion Estate. —Average yearly increase on the control plots, for the 5 years 1912-17, is 4·07 pods per tree. The value of this increase is $12.21 and the cost of manuring $11.95 resulting in a gain on manuring of $0.26 per acre per annum.

Santa Isabella Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 7·24 pods per tree. The value of this increase is $18.68 and the cost of manuring $11.33 resulting in a gain on manuring of $7.35 per acre per annum.

Soconusco Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 8·76 pods per tree. The value of this increase is \$26.28 and the cost of manuring \$13.45 resulting in a gain on manuring of \$12.83 per acre per annum.

4 cwt. Dissolved bones, 75 lb. Sulphate of ammonia and 1¼ cwt. Sulphate of potash per acre.

Santa Teresa Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 3·04 pods per tree. The value of this increase is \$9.12 and the cost of manuring \$13.51 resulting in a loss on manuring of \$4.39 per acre per annum.

Perseverance Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 4·35 pods per tree. The value of this increase is \$13.05 and the cost of manuring \$12.82 resulting in a gain on manuring of \$0.23 per acre per annum.

LIME PLOTS.

5 cwt. Lime per acre applied every alternate year.

Santa Marta Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 0·55 pods per tree. The value of this increase is \$1.65 and the cost of manuring \$0.53 resulting in a gain on manuring of \$1.12 per acre per annum. The application of lime on this estate was discontinued after the first year as the soil naturally contains a sufficient quantity of this ingredient.

New Grant Estate.—This plot has given identically the same increase as the control plots during the 5 years 1912-17. The average cost of manuring was \$2.15 and therefore the loss on manuring is \$2.15 per acre per annum.

Esperanza Estate.—This plot has given an average yearly decrease on the control plots, for the 5 years 1912-17, of 1·81 pods per tree. The cost of manuring was \$1.47 per acre per annum.

La Compensacion Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 1·26 pods per tree. The value of this increase is \$3.78 and the cost of manuring \$1.71 resulting in a gain on manuring of \$2.07 per acre per annum.

Santa Isabella Estate.—This plot has given an average yearly decrease on the control plots, for the 5 years 1912-17, of 3·31 pods per tree. The cost of manuring was \$2.11 per acre per annum.

Soconusco Estate.—This plot has given an average yearly decrease on the control plots, for the 5 years 1912–17, of 1·20 pods per tree. The cost of manuring was \$2.20 per acre per annum.

Brooklyn Estate.—This plot has given an average yearly decrease on the control plots, for the 5 years 1912–17, of 1·59 pods per tree and the cost of manuring was \$1.96 per acre per annum.

5 cwt. Lime and 2½ cwt. Dissolved bones per acre. Lime applied every alternate year.

Santa Marta Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 0·10 pods per tree. The value of this increase is $0.30 and the cost of manuring $5.49 resulting in a loss on manuring of $5.19 per acre per annum.

New Grant Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 1·32 pods per tree. The value of this increase is $3.96 and the cost of manuring $8.49 resulting in a loss on manuring of $4.53 per acre per annum.

Esperanza Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 2·06 pods per tree. The value of this increase is $5.31 and the cost of manuring $5.52 resulting in a loss on manuring of $0.21 per acre per annum.

La Compensacion Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 6·01 pods per tree. The value of this increase is $18.03 and the cost of manuring $6.22 resulting in a gain on manuring of $11.81 per acre per annum.

Santa Isabella Estate.—This plot has given an average yearly decrease on the control plots, for the 5 years 1912-17, of 7·28 pods per tree. The cost of manuring was $6.53 per acre per annum.

Soconusco Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 0·67 pods per tree. The value of this increase is $2·01 and the cost of manuring $8.11 resulting in a loss on manuring of $6.10 per acre per annum.

Brooklyn Estate.—Average yearly increase on the control plots, for the 5 years 1912-17, is 3·71 pods per tree. The value of this increase is $9.57 per acre per annum and the cost of manuring $6.49 resulting in a gain on manuring of $3.08 per acre per annum.

PROGRAMME OF CACAO EXPERIMENTS AT RIVER ESTATE.

A MEETING of the Cacao Committee of the Board of Agriculture was held at River Estate on December 6, 1917. Present: Mr. W. G. Freeman, (Acting Director of Agriculture) Chairman, Messrs. J. d'Abadie, A. B. Carr, W. S. E. Barnardo, W. C. Jardine, J. de Verteuil, (Superintendent Field Experiments), L. Seheult, (Acting Manager River Estate), and F. W. Urich, (Entomologist and Acting Honorary Secretary Board of Agriculture.)

The Committee visited the following experiment plots: Budding and Grafting, Chupons, Shade and No Shade (Younger trees) and the Manurial experiments in Field 1.

The following proposals submitted by the Acting Director of Agriculture were considered and agreed to:—

1. *Budding and Grafting Experiment*, with and without shade, to continue as at present.

2. *Chupon Experiment* to continue as at present.

3. *Shade and No Shade* (Younger trees). To continue, but as the full shade plot is becoming very heavily shaded, steps to reduce the amount of shade in this plot appear necessary.

4. *Shade. Partial Shade and No Shade* (Older trees). To continue as at present.

5. *Planting Distance Experiment.* To continue as at present.

6. *Manurial Experiment.* Small Scale in Field 1. The seven years results shew an increase of crop in most cases, but with a monetary loss when cost of manure is taken into account. Yearly applications of manure on the present scale can thus not be recommended. As manures are not available now, except at prohibitive cost, it is suggested that records be kept of the plots for another one or more years without any manures being added, and that subsequently either the same quantities of manure be applied at longer intervals (say every other year), or smaller quantities be added yearly.

7. *Manurial Experiments.* Field 6. Applications of manures might be discontinued and these plots used later for experiments in contour draining and other cultural work suitable for hill sides.

8. Cultural Work. (New Experiment). That in Field 3 the following experiment be started on the seven plots of which the natural yields are known:—

Plot 1—Ordinary forking.
„ 2—Weeding.
„ 3—Deep forking and turning over (to within 3 feet of the trees).
„ 4—Cutlassing (Control Plot).
„ 5—Deep forking and turning over (to within 3 feet of the trees.)
„ 6—Deep forking and turning over, right up to the trees.
„ 7—Cutlassing (Control Plot).

9. *Replacement Poor Bearing Trees* (New Experiment). That in Field 2 on the eight available plots in which the yield of each tree is known the following experiments be made:—

Plots 1 and 5—Bud from selected trees on chupon of the poor bearers—the latter being cut out.
„ 2 „ 6—Remove poor bearers and replace by seedlings of selected trees.
„ 3 „ 7—Remove poor bearers and replace by Calabacillo seedlings to be budded from selected trees.
„ 4 „ 8—Control, *i.e.* leave all present trees in.

10. *Spraying* (New Experiment). That two fields, Nos. 8 and 9 of known yield be utilised for a large scale spraying experiment under the supervision of the officers of the Board of Agriculture. The Estates can defray the cost of the spraying.

The following proposals, made by Messrs. Jardine and Carr respectively, were also adopted:

11. That in the Older Shade and No Shade plots the nitrogen contents of the soil be determined about the end of March, June, September and December of one year.

12. That experiments be made to determine the value of forking young cultivation, *e.g.* contracts just taken over.

(Sgd.) W. G. FREEMAN,
Chairman.

December 6, 1917.

RECENT WORK ON BUDDING & GRAFTING CACAO.

In a paper entitled "Notes on the budding of cacao on an estate scale in Trinidad" delivered by Mr. W. G. Freeman, before the Agricultural Society on January 14, 1916, he makes the following statement: "The other and not less important question as to whether we can use budding as a means of improving the yield of an established plantation *i.e.* by budding on new growths from poor bearing trees, which have been cut back for the purpose will be dealt with by separate experimental work."

Mr. Freeman afterwards instructed me to experiment with this object in view, and the following notes to date may be of interest.

On March 21, 1917, a set of experiments on a small scale were commenced on the old cacao plot in the St. Clair Experiment Station. The following methods of grafting were tried but all proved complete failures. Four triangular crown grafts were put on old stems and three on chupons; four clefts grafts on old stems and three on chupons.

On the same date six chupons were also budded but only one grew. This one has since made rapid growth, and at five months from the time of insertion the bud has made an upright growth of 32½ inches, and has already begun to branch.

Owing to the small number of trees at St. Clair suitable for budding on I next visited River Estate on June 19 and had 20 buds inserted on chupons of varying sizes.

On July 4 of the 20 buds inserted 19 were alive. The budding tape was removed at this stage and the top of the chupons cut off a few inches above the point of insertion. On July 19, just one month from the date when the buds were put on, 9 buds were growing well, some having shoots half an inch or more in length; 9 others were alive, and showed every signs of soon making growth, one bud had been injured by an animal damaging the tree, but only one had failed to make a union with the chupon.

On August 23, the plot was again gone over, and 19 buds were found to be alive, 14 of them having growth ranging from 1 inch to 2 feet: the average being 9 inches. The remaining five, including the damaged one were just commencing to burst into growth. On this latter date all chupons on which the inserted buds had burst into growth were cut back close above the point of insertion. By November 27 the average growth of the whole 19 was 30 inches.

This rapid growth in a period of little over five months from the time of insertion is remarkable and is in marked contrast to the somewhat slow growth made by buds inserted on calabacillo stock in bamboo pots.

From these results, it appears that the budding of chupons is both possible and the percentage of successes large enough to make it practicable, and the next point to thresh out must be settled by the laying out of an experiment on poor bearing trees, to see if their yield can be improved by the insertion of buds from heavy bearing trees. (1)

R. O. WILLIAMS.

(1.) An experiment to determine this point will be found detailed as item 9 of the preceding report on Programme of Cacao Experiments at River Estate.—[ED.]

STOCK BREEDING IN TRINIDAD AND TOBAGO.

STOCK breeding in the Colony has formed the subject of discussion at two meetings of the Board of Agriculture during the past year. At the first the Board had before it the memorandum, reproduced below, by Mr. A. A. Cipriani the Honorary Secretary of the Trinidad Breeders Association. The matter was then adjourned to allow of copies being obtained of the paper on "The Improvement of Native Cattle in Jamaica" by Mr. H. H. Cousins, Director of Agriculture in that Colony which is also reproduced here. To these have been added a paper on "Stock Breeding and Dairying in Trinidad" written by Mr. C. W. Meaden when Manager of the Government Farm and published in 1900, and Notes by Mr. J. McInroy and Mr. H. Meaden the Managers of the Government Farms in Trinidad and Tobago respectively.

At the meeting of the Board in October, 1917, His Excellency the President appointed a Committee to report generally on Stock Breeding in the Colony.

HINTS ON THE BREEDING OF STOCK IN TRINIDAD.

By ARTHUR H. CIPRIANI,
Honorary Secretary, Trinidad Breeders' Association.

THE breeding of stock in this Colony to supply its own needs is one of those industries which must engage the serious attention of capitalists as well as that of the local government in the near future.

The colony is to-day wholly dependent on outside sources for this supply, its chief source being the neighbouring Republic, Venezuela, supply from which may be described as indifferent in quality, uncertain and irregular in delivery, factors entirely dependent on the somewhat erratic governments of South American Republics and the unsettled and easily unbalanced temperament of its people.

FIGURES.

The imports of stock into the Colony annually are roughly represented by the following figures:—

Cattle...	£ 45,000
Mules...	7,000
Horses	4,000
Smaller stock including poultry	12,000
	£ 68,000

making up the handsome total of £68,000, at least 75 % of which leaves the Colony never to return again.

ECONOMIC.

It is quite true that it would require time and a great deal of Capital to make Trinidad self-supporting in this direction, but the case which I wish to make out, to meet present day conditions, is rather to place us in the enviable position of being stock breeders of sufficient status to be able at least to control price and quality of all imports of stock locally, a position in which we are at present helpless, and one which can only be brought about by our being able to supply local needs over certain periods in the case of a hold-up, as in the case of frequent internal troubles in Venezuela or the hundred and one contingencies which crop up in the delivery of water-borne supplies.

HISTORY.

It will be urged that Trinidad is not a country suited for the purpose of breeding stock, and while this may prove to be correct after being put to the test, I contend that any such statement at the moment is puerile, without foundation and premature, since stock-breeding has never been undertaken on a scale of any magnitude locally (an almost indispensible factor) the average creole resting content with the several tales and superstitions handed down from father to son, and no one ever making a single effort to tackle the industry on modern and reasonable lines.

PASTURAGE.

The question of pasturage is one which no doubt will be laboured, but again, in this direction our people have no experience, and in venturing any opinion on the subject, are only airing their knowledge of which happens in a small paddock of a few acres overcrowded with stock, and upon which all stock grazed are expected to keep in prize condition.

Grasses.—Our chief grasses are Guinea grass, Para grass and what is commonly known as Savannah grass.

Guinea grass is indigenous to Tobago and in that island as well as in Jamaica, the largest stock raising island in the West Indies, it is considered the equal, if not the superior, of any known grass.

Para Grass is indigenous to Trinidad and proved to be a very high class fodder, as a matter of fact, it is a question whether it is not the equal of Guinea grass at any time.

Savannah Grass grows on all local paddocks or commons, and although much maligned, has the peculiarity of providing cattle with excellent grazing.

Drought.—Of course there is our drought to be competed with, but if I am rightly informed, the droughts encountered in some of the greatest stock-breeding countries in the world are far more excessive and disastrous than any ever met with locally.

Fodder.—The growing of sugar cane for fodder would however prove a very lucrative investment, failing which, local breeders would only have to fall into line with other breeders to successfully combat the drought by resorting to Ensilage which could be very easily procured and at no very great cost.

DEVELOPMENT.

The possibilities of the industry with its assured cash markets locally are, I take it, indisputable, and only remain to be developed. I am a firm believer in that no industry of the kind will live unless the small man takes a lively and active part in its development, and for that reason

I suggest that certain meetings be convened throughout this island as well as throughout Tobago, holding out to them what is wanted, and what are the possibilities of the industry, instructing in the correct way to handle and rear stock, and particularly that it pays to breed good stock and is a waste of labour to breed under-sized or common stock.

Bring home to him the respective value of the one as against the other and having convinced him, and once set him on the right road, place the services of good stock at his disposal at a nominal fee always doing all that is possible to encourage him, do not satisfy yourself that you have done your duty to him by sending him a good stallion or bull for service, but endeavour to make sure he gets some progeny from the stock you press upon him, do not set up any hardships in the way of stationing bulls, stallions or other animals kept for this purpose at specified stations sometimes miles away from his residence or holding, but rather travel your stock producers around, let them be seen and become known around the entire countryside ; bear in mind that such travelling is beneficial and healthy to your stock.

DISTRIBUTION.

Eight stallions, six for Trinidad and two for Tobago and twelve bulls, eight for Trinidad and four for Tobago and four sire asses two for each place, would give a very good start.

The total cost of such a venture would be roughly—

(Stallions) Horses	£ 800	at £100 each.
Bulls	300	,, 25 ,,
Asses	600	,, 150 ,,
Goats	100	,, 5 ,,
making a total of	£1,800	

Insurance.—All animals to be covered by insurance against loss by accident or death. Such insurance is easily procurable in England or United States of America.

It would take up too much, of your time to disprove the several theories which militate against the successful launching of this industry locally, but in making the irrefutable statement that the results obtained by some of our best known breeders in a very small way it is true, but upon reasonable and correct lines have been most gratifying, and in many cases far above anything anticipated.

HORSES.

The statement that horses bred in the Colony are the equal of the best imported in the ordinary course of trade, and the undoubted superior of the great majority, admits of no doubt. Our horses grow to full size, mature early, and are true to type, have good feet, are game, honest and hardy.

CATTLE.

It is a matter of common knowledge that pure-bred bulls bred in this Colony from imported stock are purchased at very big prices for shipment to Venezuela and the other West Indian Islands for the improvement of their stock throughout the year. Our crossbreds make very valuable oxen for draft purposes and are far superior to Venezuelans as meat propositions, both in the matter of weight and the quality of meat.

POULTRY.

And it may be fairly added that in matter of small stock (with the one exception of sheep) and poultry that those grown locally compare very favourably indeed with any imported from the United States of America.

DISEASE.

A very important factor is our immunity from any of the known Stock scourges, Anthrax, Pleuro-pneumonia, Contagiosa, Glanders, Texas Fever, &c., &c., being practically unheard of.

STOCK-BREEDING AND DAIRYING IN TRINIDAD, BRITISH WEST INDIES.

By C. W. Meaden.

[Reproduced from the *Stock Breeders Magazine* Vol. i. No. 11, February 1900. Mr. C. W. Meaden was then Manager of the Government Farm, Trinidad.]

In a purely tropical country such as Trinidad the climatic conditions are not congenial to the management and breeding of stock on the principles laid down in temperate clime s, and the vigorous and early development obtained there cannot be secured in the tropics. Still, with due care and thought for what the climate calls for, a fair measure of success in rearing stock may be claimed.

The island of Trinidad is situated 10 deg. north of the Equator in the Caribbean Sea, and near the Venezuelan Coast of South America. It is the second largest of the West Indian possessions, and contains about 1,750 square miles. Trinidad cannot be described as a pastoral country; she neither produces her own meat nor milk, and the value of these products, some £100,000 annually goes out of the colony.

The government of the colony maintains a farm (St. Clair Farm it is called) primarily for the breeding of improved stock, and, secondly the production of milk for the public institutions. The Farm is situated near the chief town, Port-of-Spain, and contains about 200 acres all grass. This is sub-divided into convenient fields fenced with live hedges of a species of euphorbia, which makes an impenetrable fence.

THE ZEBU HERD.

There is a pure herd of zebus which forms the most valuable portion of the farm stock, and bulls from this breed are always in good demand. They are sold with other stock at an annual sale, and the average price for the last lot which were sold was £41. The zebu must be the foundation of all improved stocks in the tropics. They are indifferent to sun and rain, and are free from the attacks of ticks. The chief objection there may be about them is their tempers and the difficulty to moving them to strange ground. The cows are ferocious over their calves, and bite and butt and kick with more than the dexterity of mules. If conquered they will lie down and cover their udders to prevent their being handled. This irritability requires a lot of patience and time to control.

The milking herd was founded by the purchase of the best cows available, of no distinct type, but bought on their milking merit, which, of course, were not high. These were crossed by East Indian bulls. When mated well the result has been a fine large animal, long and angular it is true, but for draught nothing could excel them. The cows, by good milking, attention to the natural grasses and good feeding, have increased their milk yields fully 40 per cent., the average daily quantity for the herd being 7 quarts. The milk is analysed weekly, and the butter fat ranges from 4 to 6 per cent., according to the season. Each cow's milk is measured twice daily, and they will not give it unless the calf is allowed to "draw it down" and is tied beside them. In this way the calves get a small share and are also fed twice daily with a mixture of meals.

The attendants are East Indians, and each has fourteen cows and their calves to milk and look after. They do their work exceedingly well, and are excellent managers of their own class of animals.

THE RED POLL CROSS.

The demand for working cattle having decreased, consequently on decline of the sugar industry, it was thought desirable to introduce something by way of a change—a dual beast—that would increase the milk yield and come in for beef. This has been in some measure successful by the introduction of the Red Poll, and the photograph (1) of the bull indicates what has been done on a first trial. In the July number of this interesting Magazine it will be seen how near this animal approaches the form of a Red Poll bull pictured therein. His dam is a three-parts bred Zebu, and sire a Red Poll. The influence of the sire has been pronounced; the result being hornless, colour deep red, level back with most of the angularity disappearing. Such a breaking down of the characteristics in a first cross of such wide distinctions is very interesting.

No better cross than this could be desired for a climate like that of Trinidad, and the crossing between the Zebu and the Red Poll we can found a type suitable to the climate, maturing early, improved milkers, docile, and as butchers' beasts would give us better beef than we are at present supplied with.

I should add that the bull in question is just two years old and weighs 900 lb., his daily gain being slightly over 1 lb. His cost to keep amounted to £3 5s. 0d. principally crushed oats and cut fodder, guinea corn and guinea grass. On this and always at pasture he has done well. He would be worth at our butchers' price for beef about £11; the result may thus be considered satisfactory.

THE MOST SUITABLE TYPE OF BEAST.

A beast of 900 lb. live weight with meat bone and fleshy would be about the most desirable for our use. Joints, as they are understood in England, are unknown here, and perhaps unnecessary, as so many of the inhabitants live more upon entrees and side dishes than upon solid beef. The butchers here are supplied with beasts from Venezuela—gaunt brutes 1,200 lb. to 1,500 lb. each, all bone and muscle. They are manipulated to the principle of disposing as much bone as meat, and, therefore, scientific joints are quite out of the butchers' knowledge or desire to produce.

The heifers have done equally as well as the bull, and they are upwards of twenty in calf. They were served at two years three months by a pure zebu bull, and, as we have gone back upon the zebu, the result of the cross will be interesting to know.

(1) Not reproduced.

To encourage the supplying of our own meat, Sir Hubert Jerningham the present Governor of the Colony, has authorised the establishment of a model farm in Tobago, which Island is under the same administration as Trinidad. It is proposed to introduce bulls and sheep for the improvement of the Island's stock, which appear to be the descendants of those introduced by Robinson Crusoe. Tobago has excellent land for stock, fine nourishing grasses, splendid water, and the hills appear admirable for sheep. If this industry can be placed upon a commercial footing, the present unfortunate condition of the island will soon be improved.

THE TRINIDAD HORSES.

There is little interest in horse-breeding in the colony, the advent of the "bike" and cheap horses from America having destroyed what little interest there may have been in it. There is certainly little profit when the anxiety and expense of rearing are considered, the average price for sound young horses not being higher than £30, and oftener very much less.

The horse in the centre of the group (1) is Serpa Pinto, who was a Queen's premium horse for a couple of seasons in England. He was purchased for us by Lord Arthur Cecil from H. R. H. the Prince of Wales, and he has proved to be an excellent selection, never having cost sixpence for medicine, and his services are generally successful. Unfortunately many of the mares sent to him are altogether unsuitable to go to a thoroughbred, but the popular thing is to breed a half-bred for racing purposes, and as there are several minor races during the year, these so-called half-breds are the means of creating a lot of petty betting, which is not altogether desirable.

The two colts on either side (1) are by Serpa Pinto, out of well-bred mares of good size. The one on the left stands 15·2 h. at eighteen months old, and is otherwise well developed. It is somewhat surprising how well horses grow in a purely tropical climate like this, and where the moisture is always excessive. When made they stand the wear and tear of the climate much better than the generality of imported horses. These latter invariably go wrong below the knee, and the feet become brittle from the abundant moisture; whereas horses that are bred to the conditions of the climate give little trouble. Their feet are sound; there is no great depth of horn, but what there is is good.

(1.) Illustration not reproduced.

THE IMPROVEMENT OF NATIVE CATTLE IN JAMAICA. (1)

By H. H. Cousins, M.A., F.C.S.,
Director of Agriculture, Jamaica.

The island of Jamaica is remarkably suitable for the breeding of cattle and there are large areas of land where magnificent tropical cattle can be reared under economical conditions.

The peasantry should be encouraged to add a cow to their belongings wherever it is possible to do so and thus make possible a combination of crop and stock upon which a permanent and successful agriculture can be built up. The number of cattle in the island is capable of considerable increase if the people generally recognised the value and importance of developing live stock as a branch of their ordinary agricultural operations.

The large cattle-pens are and have been from very early days a successful and essential feature of the major industries of the colony and it is now proposed to discuss the most obvious measures calculated to benefit and improve their successful operation.

BEEF, DRAUGHT AND MILK.

Cattle are kept and bred for the three purposes of Beef, Draught and Milk, and although it is possible with some sacrifice of efficiency in each direction to combine two or even all three of these objects, it is yet an axiom of cattle breeding that specialisation is essential if the best results are to be obtained in the production of beef, of working cattle or of dairy cows.

One of the greatest evils that has crept into the management of our cattle of the medium or second grade has been that of a lack of specialisation and the indiscriminate blending of breeds without due regard to their efficiency in one of the special directions above mentioned.

The use of bulls of non-descript breeding has resulted in serious depreciation and the production of miscellaneous cattle of no outstanding merit and seriously lacking in uniformity of type and quality.

While the industry of breeding ordinary cattle barely pays 6 per cent. on the capital invested the production of high-class stock if successfully and judiciously managed may be relied on to give an average return of 10 per cent. on the investment involved.

BEEF CATTLE.

It is truly an extraordinary fact that all the best and most efficient breeds of Beef Cattle have been produced in the limited confines of Britain and that no beef breed of cattle of the first class has been evolved in any other part of the world. While selling of her best to the rest of the world the United Kingdom consistently maintains her herds of pedigree beef Cattle in a state of efficiency exceeding that of any other country in the World.

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(1) Reproduced from the *Bulletin Department of Agriculture, Jamaica* ii : 1915, 338–345. The original paper is copiously illustrated.—(Ed.)

This is due to the natural genius of the British Farmer as a Stock breeder and to the natural conditions that favour the production of the very highest type of well developed cattle shaped for the needs of the butcher and conditioned for the production of meat of the best texture and flavour. It is therefore a truism in the breeding of beef Cattle that the closer we can keep to the British Standard in Jamaica, the higher will be the quality of the beef stock.

The large proprietors who have developed the beef cattle of Jamaica have long recognised this fact and have from time to time imported from England and Scotland bulls of the best breeding of the Shorthorn, Hereford, Black Angus, Devon, Welsh, South Devon and Red Poll breeds, while even the shaggy Highlanders from the North have been tested by enthusiastic Scots resident in Jamaica. The original Spanish settlers in Jamaica introduced Spanish Cattle, red or dun animals of large size with very long horns, slow in growth, of inferior beef quality, but useful in the yoke. These were the foundation material on which the British breeds were subsequently grafted. Experience has on the whole, indicated that the Red Devon has shown itself the most adaptable to tropical conditions in Jamaica. In the lush guinea-grass pastures of the Western end of the island the Hereford has made good, while in the lowlands of the South side the Black Angus has proved itself a fine breed.

The Shorthorn has, as a rule, been disappointing and less adaptable than either the Devon, Hereford or Angus breeds, while the Highlanders, the Welsh and the South Devon have not commended themselves for further enterprise in their introduction.

Until quite recently very little had been done to control the cattle ticks in Jamaica, beyond the application of "Tar and Oil" as a smear to congested areas of large ticks on the badly infested animals and to the hand-picking of the engorged ticks in the cattle pens. The intensification of non-tropical blood in the herds with the consequent increase in the hair of the animals and the tenderness of their skins resulted in a serious increase in the tick-pest under the inadequate system of control generally prevailing on the pens.

The consequence has been that the breeding of high-class beef cattle became commercially unprofitable owing to the serious loss of calves from tick-infection and the slow maturation of the fattening gangs. By the introduction of cheap cattle from Central America about 20 years ago the blood parasite of Tick Fever was introduced into Jamaica and the tick-pest then became not merely a sucker of the blood and a depreciator of the vital forces of our cattle but an actual propagator of a parasite which destroyed the whole blood system of a susceptible animal so as to cause it the most serious loss of condition or even to die of "red-water."

When this disease first spread in Jamaica very serious losses of cattle were incurred and the best bred beef-stock were the most susceptible to the disease. By the control of the ticks within reasonable limits and the natural immunisation of the cattle that survived the attacks of the parasite, the cattle industry surmounted this attack but the deteriorating influence has remained and even "immune" cattle suffer severely from partial destruction of the blood system when badly infested with the "grass lice" which is the stage of the tick in which the Fever parasite is inoculated into the animal with fresh virulence.

In the first degree therefore, the improvement of our beef cattle in Jamaica has been hampered by the tick problem and secondly by the wide-spread prevalence of the Fever parasite wherever cattle are bred in the island. The finest breeds of Beef Cattle are the most susceptible to tick infestation and the least resistant to the fever-parasite. This fact explains the miserable animals that have frequently resulted from the use of English Shorthorn bulls of the finest breeding on a native herd of cattle.

The half-breds have remained stunted and unthrifty with long staring coats and in many cases have proved vastly inferior to their dams on which it was sought to effect improvement by the pre-potent and pre-eminent qualities of the premier breed of British Cattle the Shorthorn.

It has been found, for example, that under ordinary commercial conditions of management 80 per cent. of the Hereford calves have died whereas, under the same conditions only 10 per cent. of the progeny of the ordinary tropical cattle with a basis of Zebu blood failed to mature.

The tick-problem, therefore, lies at the root of the improvement of our Beef Cattle in Jamaica.

Since the visit of Professor Newstead in 1910, penkeepers have largely developed the spraying of cattle and the Departmental spray of Arsenic and Paranaph has found a considerable demand for this purpose. One proprietor who has used this spray consistently on several of his properties reports that it has enabled him to prime his steers for the butcher in six months' less time than under former conditions of tick-control.

The use of dipping tanks is undoubtedly indicated to be the best solution of the tick problem and Jamaica should now resolutely follow the example of South Africa, Australia and the Southern United States in this direction. It has been demonstrated at the Hope Farm that a tank as designed by Mr. A. H. Ritchie, Government Entomologist, can be erected at a cost of £25 for labour and materials which is capable of dealing with a large herd of cattle, while the cost of the Arsenite of Soda for the tank including some Paranaph to modify the scalding effect of the Arsenic on the skin of the cattle is only about 10s. per 1,000 gallons of dipping fluid.

It may be safely asserted that no large enterprise in the rearing and fattening of high class beef cattle in Jamaica can be adequately equipped without a dipping tank and it is hoped that a wide extension of dipping will very shortly be taken in hand by all the larger proprietors of cattle in the island.

With regard to the breeds of Beef Cattle, it has been proved that an element of the Zebu or Indian breeds of cattle is absolutely essential if British Cattle are to be hardened sufficiently to "make good" under tropical conditions in Jamaica. These Indian Cattle are very inferior from the butcher's point of view and an English breeder would find the whole animal from rump to snout seriously mal-formed from the point of view of the best production of the best joints in the most economical compass.

The influence of this blood is, however, so remarkable that one-eighth of Zebu blood is quite enough to give a short-haired character and darkening of the skin to a composite animal while preserving in a marked degree the beef qualities inherent in the remaining $\frac{7}{8}$ of British blood. The Shorthorns and the Hereford, for example, have a tender, white skin which is very susceptible to the influence of the tropical sun. The Zebus on the other hand, even when externally light-coloured or white, have a black sun-resistant skin.

It is as impossible for a white man to labour in the plains of Jamaica exposed to the full heat of the sun as for a pedigree Shorthorn Steer to thrive in a lowland pasture under similar conditions of solar exposure.

We must therefore abandon the idea of acclimatising British Cattle in the plains of Jamaica in the pure state. It is an attempt to defy the laws of nature and doomed to failure.

On the other hand the infusion of 10 to 20 per cent. of the tropical blood of the Zebu is fully adequate to give us an animal otherwise composed of pure British blood which, while externally conforming quite closely to the British standard of shape and make, has yet the protection of a pigmented skin and of short hair which tropical conditions demand for the natural well-being of the cattle.

Breeders in possession of old-fashioned beef-herds of British strains are therefore strongly advised to use Bulls of an Indian-British cross.

One of the leading cattle breeders in the island has adopted this plan with the old-established herds of Beef Cattle on his properties in St. Ann's with the most remarkable and gratifying results.

The herds have been renewed in vigour and size and the steers are now ready for market at least 12 months earlier than heretofore.

The practical problem facing the breeder arises in the second stage of this system of breeding.

If Indian-Angus or Indian-Hereford or Indian-Devon bulls be used as a first out-cross on old-fashioned Jamaica beef cows, the progeny are bound to be satisfactory, but the question is what to do next?

If a continuation of cross-breeding be adopted from the half and quarter-bred progeny, the Mendelian variations will become evident with the throw-backs to the original types and there will be a sad lack of uniformity and of real beef-quality in the progeny.

It is asserted with confidence that pure-bred British bulls should be used on the quarter-bred Indian heifers resulting from the first infusion of Indian blood into the beef-herd if a high standard is to be maintained and that $\frac{1}{8}$ of Indian blood will be found quite adequate to harden the $\frac{3}{8}$ of native and $\frac{1}{2}$ of pure British blood in the resulting generation.

The importation of pedigree bulls for this purpose is out of the question except for proprietors of large means owing to the first cost of the animals, the grave risk of loss from tick-fever, the expensive maintenance of an imported bull in the tropics and the frequent periods of lack of virility to which an imported sire is liable while subjected to attacks of fever.

It is clearly the business of the Government through its Department of Agriculture to breed pure-bred Bulls from pedigree imported stock. Jamaica-born cattle are more or less immune to fever and can be handled without much extra expense or trouble by the average cattle breeder.

A start has already been made in this direction at the Stock Farm at Hope with the Red Poll and Jersey breeds. Of the former breed 21 bulls the progeny of imported parents of pedigree stock and of the latter 15 pedigree bulls have already been distributed to breeders and the reports to hand show that a large majority of these animals have developed into serviceable sires with a very low proportion of loss and failure.

As funds may be available it is now proposed to develop this enterprise with special reference to the production of pure-bred British Beef Bulls for crossing on the quarter-bred Indian Cattle already referred to.

With regard to the most desirable breeds for this purpose I am inclined to the view that Black Angus and Sussex would be two very serviceable breeds at the present juncture. There is already a good deal of Angus blood in some of the best herds and the crosses with Hissar cattle from India are among the finest Beef Cattle yet produced.

The Sussex commends itself largely on the basis of South African experience, while some personal contact with the breed in Kent where it is highly esteemed for fattening purposes by Hop-growers, to whom farm yard manure is a prime necessity, supports a favourable opinion in favour of Sussex cattle for use in Jamaica.

The Sussex are practically an enlarged edition of the North Devon, darker in colour and in former days of great merit in the yoke, mature steers attaining an enormous size. The cows are never milked and the breed has been developed purely as a beef-breed in the South-Eastern section of England. Good stock is obtainable at farmer's prices and competition with South American millionaires does not at present involve the payment of fancy prices for Sussex cattle of good type.

Herefords and North Devons have already been tried and are quite a success where the conditions are suitable. Some prejudice against the latter owing to the introduction of a tubercular strain of these cattle some years ago in the west end of the island still persists. This however, is an individual failing and not a characteristic defect of the North Devon Cattle and should be avoidable by proper testing and selection of the stock before they are imported.

British Cattle for export to the Tropics can now be tested for Tuberculosis by the Board of Agriculture and Fisheries in England and immunised for tick-fever before despatch.

DRAUGHT CATTLE.

The old Spanish Cattle in Jamaica were useful animals in the yoke albeit somewhat slow and deliberate in their paces. A residuum of this useful type still remains here and there, particularly where Cuban settlers have established themselves in Jamaica.

Of all the British breeds the Hereford was formerly considered the most useful on the Sugar Estates for working purposes, although the terrible mortality of cattle that occurred when hard times overtook an Estate in an unfortunate season showed that Herefords were not really hard enough for severe conditions in the tropics. The introduction of Zebu Cattle from India revoluntionised the working cattle of Jamaica. An account of their introduction and the experience obtained with the different breeds of Zebus in Jamaica has already been given in this Bulletin by the Hon. B. S. Gosset.*

Not only is the Zebu a tropical ox with dark skin affording protection from the tropical sun and possessing a coat of short hair, but it is also naturally resistant to ticks and to tick fever. In size, length and scope of limbs and speed and power in the yoke the choicest breeds of the Zebu are far ahead of British Cattle for purposes of draught, and their introduction into Jamaica has resulted in an enormous improvement in the efficiency of the native cattle for this purpose.

The chief breeds of Zebu that have left their mark on our native cattle are (a) the Mysore, (b) the Harriana from the Government Farm at Hissar in India, (c) the Gujerat and (d) the Nellore or Ongole.

The Mysore cattle must be regarded as the thoroughbred horse among Indian Cattle and are supreme in the essentials of quality for quick draught and endurance in the yoke. Although lighter than the other three breeds mentioned above, the Mysore are supreme in hardness of hoof and spirit and if it is desired to improve an inferior grade of Zebu Cattle to a higher standard for working purposes the Mysore must be regarded as the best for this purpose. Now that the present owners of Montpelier Pen are willing to sell pure-bred bulls in the island it should be possible for the Mysore breed to be utilised to great advantage in grading up second quality herds of cattle of Indian strain to a higher standard of quality.

The pure-bred Mysore is inclined to be light and less substantial than Estate managers would like but in actual working experience it has been shown that these cattle are the hardiest, staunchest and most reliable draught oxen yet tested in the island. Fresh blood from the herds in Mysore is now desirable in order to maintain a high standard of this breed in Jamaica, although experts from India have recorded their opinion that they are finer specimens of the Mysore to be seen at Montpelier in Jamaica than in India itself.

The "Harriana" breed has proved itself a magnificent outcross on the old-fashioned native cattle of Jamaica, the largest and finest steers ever seen in the island having resulted from this cross.

Mr. Gosset was a pioneer in this direction and the 150 bulls, the progeny of his original importation which he distributed to other breeders in the island have to-day achieved a most remarkable triumph in the widespread [diffusion of the Harriana blood into herds all over the island.

The Gujerat is a fine well-developed breed of Zebu cattle and some magnificent half-breds have been produced in Jamaica but experience has indicated that under pen conditions in Jamaica this strain is apt to lead to a very excitable and unmanageable type of cattle.

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* *Bulletin Department of Agriculture, Jamaica*, i., 1909–11, 102 and 256.

The Nellore or Ongole breed of Southern India is in its native land one of the largest breeds of Indian Cattle, very docile and specially suitable for heavy draft at a slow pace.

In Jamaica the half-bred progeny of the Nellore have shown a lack of constitution and the cows to suffer a good deal during a period of dry weather. This breed has not done so well as the others mentioned above in grading up the cattle of Jamaica while the experience of Mr. Gosset has led him to believe that the Harriana is the best type of Zebu for general use in Jamaica.

Owing to their excitable nature when reared in almost complete freedom on a cattle pen where the handling of an animal is a somewhat rare event in its existence, many breeders have been seeking for a moderating influence on their cattle of Indian blood. The problem is rather a difficult one as resort to any British breed is bound to reduce the hardiness and efficiency of the cattle for severe work in the yoke.

Mr. Gosset has had very encouraging results with the Porto Rican outcross, (Bulletin Vol. 1 p. 259), although this breed tends somewhat to reduce the size of the Indian cattle.

There is, however, a marked accession of docility from the Porto Rican blood, while the vitality of the progeny is so great that the herds have rapidly increased where this strain has been introduced into the Jamaican cattle.

Last year a very interesting experiment was initiated by Mr. Ellis of Fort George Annotto Bay, in the introduction of two bulls of the "Val di Chiana" breed from Central Italy.

These cattle are highly thought of in Italy for draught purposes and are of remarkable size. Despite their white hair, their skin is dark and they should therefore be resistant to the tropical sun.

It is considered that these cattle are a survival of the very large breed of cattle that formerly existed in Central Europe to which Julius Caesar makes reference.

There is also a theory that when Alexander the Great invaded Northern India he took back to Europe some of the fine Zebu cattle from that country and that traces of this blood are to be found in the modern cattle of the "Val di Chiana" in Italy. The larger bull (Plate 73)(1) measured 15 hands 2 inches at 1 year and 11 months, the younger animal 14 hands 1 inch at 12 months. The younger bull gives promise of developing into the finer and more symmetrical animal of the two.

These bulls are being crossed on high-grade Indian heifers and the result should be the production of grade cattle of superior size and substance and of greater docility. The outcome of this experiment is being eagerly awaited by our leading breeders of draft cattle and if the results are satisfactory further importations from Florence will be made.

DAIRY CATTLE.

A general account of the Dairy industry in Jamaica was given by the writer in the last issue of this Bulletin* (No. 7 pp. 253-287) in which it was indicated that the improvement of the native dairy cattle of Jamaica could be brought about by a development of the Zebu-Jersey and Zebu-Guernsey races. Very promising results have already been obtained at Hope with the former of these combinations, while a beginning has also been made with the production of the Zebu-Guernsey.

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(1) Not reproduced.

* *i.e. Bulletin Department Agriculture, Jamaica.*

For dual-purpose cattle for the production of Beef and Milk the Red Poll is also a very promising introduction. Plate 71(1) gives a good illustration of an animal with a quarter of Red Poll blood from the herd of Edward Pratt, Esq., in St. Ann's, which shows the prepotence of this breed when used as an outcross on the native cattle of Jamaica.

That it is possible to rear creditable Red Poll Cattle in Jamaica is demonstrated by Plate 72(1) in which the Red Poll Bull "Sudbourne Crowfoot" is represented. This animal was bred in England by Kenneth M. Clark, Esq., at Sudbourne Hall and was sired by the famous bull "Acton Crowfoot" from Sir Walter Corbet's herd out of the celebrated cow "Desiree of Johnstown."

"Sudbourne Crowfoot" was born in Jamaica and reared by a small native cow. He has lived continuously out of doors and has thriven steadily throughout his career. When exactly 3 years of age he weighed 200 lbs. more than did our imported bull, "Rendlesham Royal Bey" at the same age.

The Red Poll cows at Hope have consistently led all the other breeds, imported and native, in milk production besides being of good beef conformation.

When crossed with good cows of Indian blood some very useful cattle should result from the use of pure-bred Red Poll bulls in Jamaica.

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(1) Not reproduced.

NOTES ON STOCK BREEDING IN TRINIDAD.

BY J. McINROY.
Manager of the Government Farm Trinidad.

I have read the very interesting article on the improvement of Native Cattle in Jamaica, by the Director of Agriculture, Jamaica.

It would appear that although the existing conditions governing the breeding of cattle in Jamaica are nearly the same as exist here, there are some features that differ. The greatest drawback to successful cattle breeding in Jamaica is said to be the prevalence of ticks, no mention is made of the Strongylus parasite that is so prevalent in Trinidad. Ticks are also a pest here especially among cattle of more than half European blood, but, thanks to our native tick birds the pest is kept in check. There is no doubt the dipping tanks mentioned would be advantageous to stock raising here, the spraying of arsenic not only rids the animal of ticks, but poisons the host on which the parasite lives thereby ridding the pastures of the pest.

Experiments as to the cattle best suited for Milk, Draught and Beef purposes have been carried out at the Government Farm since its inception in 1879. Zebu cattle were then introduced to improve Draught Oxen. The improvement on that line has been amply demonstrated, and Trinidad possesses to-day possibly the best working oxen to be found in the West Indies. The Zebu Cattle introduced were of the Ongole breed, Nellore, Gujrat and Kistna types. No Amrat Mahal breed, under which the Mysore type mentioned comes, were introduced. About 20 years ago Trinidad supplied Jamaica with a number of Zebu bulls.

I think there is no doubt that in introducing the Zebu breed to improve the working oxen, that object has not only been obtained, but a breed of cattle has been introduced by which it is possible by crossing to raise a hardy breed of cattle suitable to the tropics whereby Milk and Beef qualities can also be improved. In the Farm Records, the first mention of Shorthorn Cattle being introduced to improve Beef and Milk was in 1886. Since then Guernsey, Jersey, Holstein, Hereford, and Red Polls have been tried. Guernsey, Jersey and Holstein for Milk, and Shorthorn, Hereford and Red Poll for Beef. Shorthorn and Red Poll have proved themselves in Trinidad the best dual purpose animals (Milk and Beef). As in Jamaica it has been proved that pure-bred European stock cannot stand our climatic conditions, and I agree with Mr. Cousins that to breed pure-bred European stock in the tropics is in defiance to the laws of Nature and doomed to failure. I do not agree with him, however, that 10 to 20 per cent. of tropical blood is sufficient to overcome the climatic conditions. My own experience in Trinidad is that at least 25 per cent. tropical blood is required to make the animal immune and fit for tropical conditions. In instances where a half-bred Red Poll cow has been bred to a pure-bred Red Poll bull, the progeny being 75 per cent. European blood, 12½ per cent. Zebu blood and 12½ per cent. native or other blood, the progeny show want of stamina, remain stunted and unthrifty with heavy staring coats, suffered from heat, ticks and all diseases prevalent. When an animal of this breeding is compared with a half-bred of 50 per cent. European blood, 25 per cent. Zebu blood, and 25 per cent. Native or other blood, the contrast in favour of the half-bred is overwhelming, even to anyone with no particular knowledge of stock-breeding.

It may be asserted that 25 per cent. of tropical blood will tend to lessen the beef qualities sought after, but if care is taken by careful selection, this can be avoided, as the European blood being dominant the external form of the breed to be perpetuated will be maintained. In cases where the offspring does not come true to type, the animal need not be kept for breeding purposes.

I think for working purposes it is fully recognised that the half or three-quarter bred Zebu cannot be surpassed. Notwithstanding the opinion expressed by Mr. Cousins, with regard to the Shorthorn, my opinion is that the half-bred Shorthorn and Red Poll have proved themselves the best dual purpose animals in Trinidad for Milk and Beef. The half-bred Hereford in a few instances did excellently for Beef, but is more subject to tropical diseases. The half-bred Jersey and Guernsey make excellent milkers but fail as beef producers. Bulls of these two breeds should be kept at the Government Farm for breeders of Milk cattle only. The Holstein is of too soft a nature to withstand tropical conditions. The Polled Angus is highly spoken of in Jamaica. This breed has not been tried in Trinidad, it holds first place in Britain as a beef producer, they are not heavy milkers, but the milk is said to be rich. I would like very much to see this breed tried here.

The Standards of British Cattle have been raised to a very high point, and when it is considered that most of the breeds are made-up breeds, I think it is quite possible, by the infusion of tropical blood, to raise our own thorough-bred Red Poll or Shorthorn breed to be called "The Trinidad Pure or Thorough-bred Red Poll or Shorthorn." This would help to raise stock-breeding in Trinidad to a higher level and the class of cattle produced would be in demand in the West Indies and Central America. A start will be made on these lines at the Government Farm shortly.

There is no doubt that the greatest drawback to successful stock raising in Trinidad is the prevalence of parasitic diseases; our hot moist climate lends itself to the propagation of these pests. The failures in the past have been mostly put to the nature of our grasses; but I think the greatest drawback is the excessive amount of parasitic life existing in our pastures all over Trinidad. No persistent attempt has been made to rid the pastures of this pest, but unless that is done, and done thoroughly, cattle raising in Trinidad will never be a success. There is no use treating our animals medicinally if they are again to be placed in a parasite infested pasture.

Strongylus in animals is like hook-worm in the human being, but in the present stage of the knowledge possessed is harder to clear out of the system. Veterinary Surgeons state that it takes five years before some animals' systems can be rid of the parasite.

Stock raising in Jamaica is evidently carried on under more favourable circumstances than exist in Trinidad, if, as represented by Mr.

Cousins, 6 to 10 per cent. on the capital involved may be expected. Some people in Trinidad are of opinion that stock-raising can be carried out on a commercial basis here. With all due deference to their opinion, I do not think men of experience will endorse that view, the difficulties I have mentioned must first be overcome before any such idea be realised. It is possible to overcome the grass difficulties during the prevalence of drought through the erection of silos or other means, but to eradicate the parasites from our pastures will not so easily be accomplished and if the parties that hold the view that cattle breeding can be placed on a commercial basis could suggest some easy method of overcoming this evil, they would be conferring more good on the community than by reams of theoretical reports.

NOTES ON CATTLE BREEDING IN TRINIDAD AND TOBAGO.

By H. Meaden,
Manager of the Government Farm, Tobago.

From years of experience with various breeds, I am of opinion that breeding pure bred European cattle in the Colony has been an utter failure, and will continue to be so for all time, as they cannot stand the climate, they have not the rich pasture, nor do they get artificial food, roots, &c., equal to that given in Europe or America. The feeding of European cattle is now a fine art, not practiced in the West Indies, mainly on account of its high cost (not war) against small receipts, and certainly also for want of knowledge of the different food values, consistency, &c.

I am convinced that the best cattle would be obtained by crossing *Pure-bred European* with *Pure-bred Zebu* in the first stage, then use the bulls from this cross all over the Colony to approved cows by *selection* if possible at a low fee of say 4s. or even free services if in a Government pasture.

If a cow shows marked Zebu characteristics then put her to the bull showing strong European points, or *vice versâ*: breeding by selection should be systematically adopted.

With all the European crosses tried at St. Clair and Valsayn Farms the Red Poll-Zebu cross proved by far the best, they make fine beef beasts, good milkers and not at all inferior working oxen, though they have to be fitted with a V shaped bow to prevent their heads from coming out of the yoke as they are nearly all hornless. The Guernsey cross did fairly well, especially in milk yield. There is a fine old ox 18 years old Guernsey-Zebu cross still working here. Shorthorns were not a success except in adding somewhat to the milk yield.

I am of opinion that almost any European breed crossed in with the Zebu will thrive and give good results—having due regard to locality. It is hardly toexpected that cattle indigenous to hilly country would be thrive as well on flat marshy land, or *vice versâ*.

The best breed of Zebu for general cross breeding for all points is the Gujerat (see pp. 34-35 Indian Agriculture by Wallace). Another breed almost equally as good is the Nagar (p. 38 above).

The Government herd of cattle should be divided or even subdivided so as to breed for something definite, such as beef beasts and oxen for working purposes; the mothers of these should not be milked, leaving all for the calves, all large cows and poor milkers should be segregated to this division.

The next division should be for milk only—the calves should be hand fed as far as possible.

A special division of pure bred Zebu cows with any chosen European bulls (pure bred) or the other way about, to raise good bulls for distribution. It is utterly impossible to expect good results from cows that are constantly milked twice a day; the progeny are generally half-starved, take at least six months longer to develop than calves allowed to run with their dams.

In *Journal of Heredity* 1915, p. 208 will be found a picture of a Hereford-Zebu cross (both pure breeds). I know a similarly bred cow now about 12 years old, probably the first cow in the island and a good milker and never out of condition.

The Stockbreeders Magazine, February 1900, contains an article on "Stock Breeding and Dairying in Trinidad" by my father, then Manager of the Government Farm, Trinidad. (1) In it are a couple of pictures showing the type of Cross Red Poll-Zebu raised at St. Clair.

Dipping is now found so beneficial that no cattle-raising establishment should be without the necessary appliances. Cooper and Nephews seem to be the most reliable firm. A couple of dippings a year makes all the difference in the world from a health point of view.

The pure Zebu strain should be maintained. Cross Zebu and the Red Poll for beef and milk. Cross Zebu and native cattle for oxen. Cross Zebu and Jersey or Guernsey for milk. The Holstein is becoming a prominent breed and might combine all three qualities beef, milk and working oxen.

(1.) Reprinted. See pp. 206-8.

NOTES ON THE PROPAGATION OF LIMES.

By R. O. Williams,
Curator, St. Clair Experiment Station and Royal Botanic
Gardens, Trinidad.

There are three principal methods of propagating Limes, viz.: (1) Seedlings (2) Budding and (3) Layering. The former is at present the most important, and the one almost universally practised. Budding and Layering may however be described briefly before dealing with seedlings.

BUDDING.

There appears at present no definite evidence to warrant the budding of limes on a large scale except for increasing some particular variety such as the seedless, or for cultivation under some unusual conditions of soil &c. A very high percentage of ordinary limes come true from seed; the lime is also one of the hardiest Citrus stocks in Trinidad. Until further evidence is forthcoming it is uncertain whether the much greater expense involved by preparing budded plants is likely to be compensated for by either increased vigour or productiveness.

LAYERING.

Layering is performed usually by removing a ring of bark, about an inch or so in length, from around a branch just below a node and tying wet moss or soil in a piece of sacking around the wound, which is kept well moistened during dry weather.

A callus quickly forms at the upper edge of the cut out area and roots develop. This method yields in a short period large plants as supplies if needed for an existing plantation. It thus presents certain advantages under special circumstances, but it is somewhat impracticable on a large scale as many trees would be required to give a large supply of layered plants.

SEEDLINGS.

The principal method of raising limes is by seed. This is by no means an easy matter under Trinidad conditions; in fact they are the most troublesome plant which we raise in the nursery in any quantity, therefore special care and conditions have to be given them.

After personal trials of various methods of sowing, time of sowing, condition of the soil, &c., at the St. Clair Experiment Station, it may be useful to place on record the method which has been found to be most successful, especially as the preparation of the soil with heavy dressings of organic matter, as advised in some West Indian publications, has been found to give bad results here.

Fungoid Diseases.

The chief trouble in the raising of limes from seed lies in the susceptibility of the young seedlings to fungus attacks, but once past the seedling stage they grow readily and give less trouble than, for instance, cacao and coffee.

The "damping off" fungus which attacks many plants during the first few weeks of their growth is especially harmful to limes. It is to be recognized by the stem and leaves of the young seedlings turning black, falling over and dying within a short time. The old adage, prevention is better than cure, is especially applicable in this case, and strict attention should be given when sowing the seed to see that such conditions be given as are most likely to keep the fungus in check; these I will try to describe. In the event of the disease being detected in the seed beds spray with Bordeaux mixture at once, repeating the process at frequent intervals especially if the weather be showery. In Dominica it has been found that dusting the seedlings with sulphur and lime is also a good remedy.

Another fungus which also does harm to lime plants in the first year or so of their growth is recognized in the first instance by brown spots on the leaves which later attack the tips of the young shoots descending down the stem, till eventually unless it is checked the whole plant is killed out. This disease is most prevalent on the young plants during rainy weather but is also brought about by a waterlogged condition of the soil or by bad cultivation.

It can be remedied more easily than can the "damping off" fungus by improving the cultivation and spraying frequently, (say once a week or so) with Bordeaux mixture, till all signs of the disease has gone and the young plants have again commenced to make new shoots. All growth which has been killed by the fungus must be cut out at once and burnt.

THE NURSERY.

Lime seeds should be sown on a *sunny, exposed piece of land*, as free as possible from humus or decaying vegetable matter, and to which manure has *not* recently been added. Last season part of the seed required for the nursery were sown in beds of fairly good soil in the Experiment Station, whilst the balance was sown on the poor stony soil on the top of the adjoining Cashew Hill. The latter were more vigorous in growth and suffered less from fungoid pests. On the hill I also sowed a bed in semi-shade to compare it with those in full sunshine, and despite frequent spraying I did not get a single plant from the shaded bed, as the whole lot succumbed to the "damping off" fungus

The land chosen for the nursery should be thoroughly forked and lined off into beds from four to five feet in width and with paths from 1½ to 2 feet between, throwing the soil from the paths on to the beds so as to raise them above the level of the surrounding soil. No trouble should be spared in the thorough working of the soil and in the preparation of the beds, as it must be remembered that good healthy seedlings will repay one by healthy stock in later years. Weakly or stunted seedlings can never be relied upon to give as good results.

Another important detail is the time of sowing and judging from our experience here, the beginning of the dry season is the best time. Seeds were sown as an experiment from time to time during the whole of the last wet season, both in beds and boxes under shelter, with but negligible results.

The last batch, and the one which gave by far the best returns, was sown in January, although even with the light showers which we then experienced for two months a certain percentage of plants were lost.

SOWING SEEDS.

The seeds after being squeezed from the fruits should be given a thorough washing to remove the coating of mucilage, and afterwards dried in the shade before sowing, as the mucilage attracts vermin and ants to them. The seeds should be sown either in drills about half an inch deep or broad cast; drills for preference as the beds can be kept weeded much easier. These should be made from 10 to 12 inches apart to allow of the use of the hoe for keeping down the weeds and frequently stirring the soil. As soon as the seedlings appear above ground, they should be given a light spraying with Bordeaux mixture and be sprayed at frequent intervals afterwards, especially if the weather be showery.

TRANSPLANTING.

When the plants are about three inches high they can be transferred to bamboo pots filled with good loamy soil, and potted quite firm. A large hole must be made in the bottom of the bamboo joint, and a good handful of coarse gravel placed in the bottom to allow of free drainage. Potting is the method practiced at St. Clair chiefly because planters will not readily buy them straight from the beds. It is not necessary however to have them potted, in fact in the other West India Islands where limes are grown on a large scale, the planters usually take them straight from the beds, and if a man has a nursery on his own estate it would certainly be better never to put his limes in pots at all, as it only retards their growth.

If the plants are to be grown in beds till they are ready for planting in their permanent positions it will be best to transplant them into other beds, when they are about four inches high, planting them about 6 inches apart. This method will give far less failures at the final transplanting.

SWORD OR HORSE BEANS.

Canavalia gladiata.

In a preceding number of this *Bulletin* (XVI, 1917, 65–7) an account was given of the Sword bean *Canavalia ensiformis.* Particular attention was directed to the fact that in addition to its use as a cover crop the beans are edible. The *Canavalia ensiformis* described is a dwarf plant with white beans.

Since that article was written a sample was received from Mr. Claude Connell of Esperanza Estate, Trinidad, of a similar but brownish yellow or red bean, which is apparently the closely related *Canavalia gladiata*, but differing in being a strong growing vine.

These beans have been analysed by Mr. H. S. Shrewsbury, Acting Government Analyst, with the following result:—

Analysis.

Appearance of Beans: Brownish yellow, flattish oval, 1 x ⅝ x ⅜ inches, with dark grey hilum half inch. The whole meal from the beans is a clean and pleasant pale cream coloured powder, with a taste and odour resembling that of pea meal.

Probable Name: Canavalia gladiata.

Examination for Toxic Properties: No evidence was found of the presence of cyanogenetic glucosides or of other toxic substances.

Nutritive Value: The table below compares the analysis of the whole meal with that of other beans:

Kind of Bean.	Carbo-hydrates.	Proteins.	Water.	Woody fibre.	Ash.	Fat.	Feeding Units.
Sample in question (? *Canavalia gladiata* grown in Trinidad) ...	53·6	25·1	12·7	2·4	2·9	3·3	125
Canavalia ensiformis (grown at St. Clair Experiment Station)..	45·2	27·6	15·5	5·4	3·1	3·2	122
Stizolobium pachylobium (grown in Trinidad)	47·2	29·2	11·0	4·1	4·2	4·3	131
Stizolobium aterrimum (Bengal beans grown in Trinidad) ...	44·3	29·8	12·0	6·2	4·2	3·5	127
Phaseolus vulgaris (French Kidney bean)	52·7	23·1	13·6	4·8	3·5	2·3	116
**Phaseolus lunatus* (Java or Lima bean)	†67·1	15·9	11·1	...	4·1	1·8	111
Vicia Faba (Field or horse bean)	49·3	23·9	14·5	7·5	3·2	1·6	113
Soja hispida (Soy or Soja bean)...	30·2	33·2	10·0	4·4	4·7	17·5	157

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*Java beans contain a cyanogenetic glucoside and their inclusion in the table is not intended to indicate their desirability as a food.

†Includes woody fibre.

It will be seen that the sample is a little superior in the figure for feeding units to French beans and also to the beans of the closely related *Canavalia ensiformis.*

The figures for these two beans, both grown in Trinidad, are generally similar. The coloured bean is perhaps of slightly greater value than the white variety, since the small deficiency in proteins would be more than balanced by the larger figure for carbohydrates and the presence of considerably less indigestible woody fibre. The decrease in the woody fibre figure is due to the larger size of the bean and consequently smaller percentage of skin, which is of a similar thickness.

The relation between the whole bean and the skin is shown by the following figures:

Weight of whole bean (average of 10)	...	2·73 grammes.
Weight of skin do.	...	·37 ,,
Average percentage of ...	...	13·5
The average percentage of skin in the white variety is	...	14·4

The nutritive value of the beans is similar or perhaps superior to the value of the *Canavalia ensiformis* and French Kidney beans. Tentative feeding experiments should be made before they are accepted as a reliable and wholesome food.

HERBERT S. SHREWSBURY, F.I.C., F.C.S.,
Acting Government Analyst.

CULTIVATED PALMS IN TRINIDAD.

The Palms of the Royal Botanic Gardens and St. Clair Experiment Station.

By R. O. Williams, Curator.

The following notes refer to only such palms as are known by name in the Royal Botanic Gardens and the St. Clair Experiment Station Trinidad. Some others are found in private gardens in different parts of the Colony, and Mr. Eugene Andre has quite a large collection at his Dabadie nurseries, included in which are several recently introduced ones not in the Government collections. There are also some palms in St. Clair which have not as yet been determined, as well as a few in the Botanic Gardens; the Sabals alone still leave quiet a field of study regarding their nomenclature. Of the twenty palms mentioned by Grisebach in his *Flora of the West Indies* as occurring in Trinidad, twelve are under cultivation in the gardens. It may seem strange that all the native palms should not be represented but some are difficult to establish under cultivation. In this connection it is of interest to quote the following from the late Mr. J. H. Hart's *Report on the Royal Botanic Gardens* for 1906-07.

"Curious to note two of the native Trinidad palms, Manicaria and Mauritia, have been found more difficult to establish than many of the foreign species. This is due probably to some unsuitable factor in the soil, or to the absence of some necessary constituent. Although the older garden is some eighty years of age, the absence of several native species is most marked."

Acanthorhiza aculeata, H. Wendl. Mexico.

A characteristic feature of this palm are the aerial roots which are borne on the stem in great abundance. Those at the base of the trunk penetrate into the soil but those higher up develop into strong, sharply pointed spines about three to four inches in length. When full grown the stem is from 30 to 40 feet high, bearing palmate leaves about six feet in breadth and silver coloured on the under surface, the lower ones lying close against the trunk. The flowers are borne in great abundance as also are the white fruits, many of which contain no seeds. The fertile fruits are about the size of marbles.

Acrocomia aculeata, Lodd. see A. SCLEROCARPA, Mart.

Acrocomia sclerocarpa, Mart. The GRU-GRU. Native.

This palm is most abundant on dry hills in both Trinidad and Tobago. It grows to a height of 20 or 30 feet, the trunk being erect and about one foot in diameter, often swollen near the summit and armed with black spines. The leaves are from 12 to 14 feet long with from 70 to 80 leaflets on either side of the main rib which is covered with strong black spines. The flowers are yellow and fragrant; the yellowish-brown, round fruits, about the size of a billiard ball, are borne in great abundance.

Gru-Gru kernels yield a valuable oil. For an analysis and report, etc., by Imperial Institute see Vol. XII. 1913, page 137-138 of this Bulletin from which the following is quoted.

"There is no doubt that Gru-Gru kernels in good condition would find a ready market in the United Kingdom at prices approximating to those of palm kernels if they can be offered in commercial quantities, *i.e.* in shipments of from 50 to 100 tons at a time." Another article by Mr. H. S. Shrewsbury, Acting Government Analyst is in Vol. XIII. 1914, 104-106.

Rough planks cut from the trunk are sometimes used for building huts. Handsomely marked walking sticks are also made from it. The young leaves are eaten as a vegetable, and the sweet pulpy portion of the fruit as well as the kernel is edible.

Archontophoenix Alexandrae, H. Wendl. and Drude. Eastern Australia.

A lofty palm, 70 to 80 feet high, with a trunk 6 to 8 inches in diameter, larger at the base. Leaves pinnate, 6 to 8 feet long, with leaflets green above and ashy green beneath, measuring 18 to 20 inches in length. Petiole 9 to 12 inches in length, flat on the upper surface with two sharp ridges merging into one on the leaf stalk the leaflets arising alternately on either side. The infloresence is about one foot in length bearing small roundish fruit about the size of peas with a somewhat fibrous outer covering slightly resembling mace.

Archontophoenix Cunninghamii, W. & D. TROPICAL AUSTRALIA, HOOK.

This is a favourite ornamental palm of variable height very similar to *Archontophoenix Alexandrae* but recognizable from that species by the under sides of the leaves being green whilst in *A. Alexandrae* they are glaucous. The pinnæ are also paler green and more thickly dispersed and the leaf stalks are much flatter. It was introduced into Trinidad in 1864.

Areca Catechu, L. BETEL NUT PALM. Malaya.

A graceful slender stemmed palm, reaching to a height of 50 feet or more with a small crown of pinnate leaves. The yellow egg-shaped fruits each contain one seed about the size of a nutmeg and with similar internal markings.

The seeds are astringent, useful in dysentery and for expelling worms in dogs. Their principal use in the East is as a masticatory. Thin slices are chewed together with a little lime and a piece of Betel Pepper leaf, and other materials according to taste. Betel chewing is regarded as a preventive of dysentery, it colours the mouth and saliva red.

An Avenue of this palm was planted in the St. Clair Experimental Station in 1915.

Areca lutescens, BORY. see Chrysalidocarpus lutescens, Wendl.

Areca madagascariensis, Mart. BAMBOO PALM. Madagascar.

A lofty palm with numerous bamboo-like stems showing distinct circular markings 4 to 6 inches apart. Leaves pinnate dark green 7 to 8 feet in length, with pinnae 18 to 24 inches in length arising from the stalk in twos or threes. The seeds are about half an inch in length. One fine clump of this palm can be seen in the Palm Walk, east of Government House, and several tall specimens in St. Clair Experiment Station.

Areca triandra, ROXB. India.

A slender stemmed palm about 20 feet high, often producing suckers at the base. The pinnate leaves are from 5 to 6 feet long with a petiole measuring about one foot. The fruit is orange scarlet and a little more than an inch in length.

Arenga saccharifera, Lab. GOMUTTI OR SUGAR PALM. Malaya.

A large palm 30 to 40 feet high, with very large pinnate leaves. It is extensively cultivated in the East for sugar; the tree is said to reach its flowering stage about its twelfth year, and to continue to bear for four or five years when it dies.

Sago is manfactured from the large quantities of starchy matter contained in the heart of the stem. By tapping the male inflorescences and afterwards evaporating the sap jaggery or Palm sugar is obtained. The sap when fermented yields toddy or palm wine. Ropes, brushes, etc., are made from the strong fibre obtained from the leaf stalks, and in Borneo, native sandals from the leaf sheaths.

Arenga Wightii, Griff. Malabar.

Several handsome palms bearing this name, are found in the Botanic Gardens. They have erect stems and produce many suckers from their bases. Leaves pinnate, very long, with segments of varying length densely glaucous beneath, and 2 lobed at the base, the largest lobes of the segments interlacing with each other over the top of the rachis. The bases of the petioles are enclosed in strong fibrous sheaths.

Astrocaryum aureum, GRISEB & WENDL. Native.

Three lofty specimens of this palm are growing in the Gardens. In the country districts of Trinidad, they attain a height of sixty feet; it is not found in Tobago. This palm is exceedingly spiny; long sharp black spines being developed on stem, leaves, peduncle and spathe. Old and young plants are alike strongly armed. The leaves are pinnate, 6 to 12 feet long, with shiny segments 4 feet long and acuminate apices.

Attalea Cohune, Mart. COHUNE PALM. Honduras and Guiana.

A handsome spineless palm growing to a height of 50 or 60 feet with large erect ultimately spreading pinnate leaves, consisting of 40 or 50 leaflets about 18 inches long. The petioles are flat on the upper service and rounded below. The large brown fruit are about the size of hen's eggs and borne in large pendant clusters. Lofty specimens of this palm may be seen in the gardens, where planted in groups, they look most effective. A tree which evidently died of old age in the Palm Walk during October, 1917 measured 73 feet from the ground to the top of the leaves, and 48 feet to the base of the lowest leaf. The leaves were about 25 feet long. The girth at the base of the trunk was 4 feet 10 inches and at twelve feet from the ground 5 feet 2 inches.

Cohune nut-oil used for illuminating purposes is obtained from the kernels. This is considered superior to coconut oil but it is costly to prepare, owing to the thickness of the walls of the fruit and the comparative small size of the kernels. Efforts have been made for many years to get a suitable machine for cracking the nuts.

Bactris major, Jacq. Native.

A slender, many stemmed palm growing to a height of 20 to 30 feet and freely armed with black spines several inches in length. The pinnate leaves are from 5 to 6 feet long, bearing from 30 to 35 leaflets on either side of the main stalk which is armed with numerous dark coloured spines of varying length. The margins of the leaflets are also furnished with black spines about $\frac{1}{10}$ of an inch in length. The flowers are yellow and fruit about the size of pigeons eggs, said to be edible. It occurs chiefly in damp lands in both Trinidad and Tobago.

Bactris simplicifrons, Mart. Native.

A moisture loving, dwarf spineless palm, with a number of very slender flexible stems 4 to 8 feet high, about $\frac{1}{4}$ inch in diameter, with circular markings where the leaves have been attached. Leaves entire, divided in the centre and about 1 foot in length. The petioles are short, scarcely exceeding one inch in length, flat on the upper surface and round beneath. The small yellow flowers are very sweetly scented and the fruit is round.

Bentinckia nicobarica, Becc. Nicobar.

Two well grown specimens of this palm are in the St. Clair Experiment Station where it fruits freely, numbers of young plants have been raised from seed which are in great demand in the Colony as a decorative pot plant, being exceptionally graceful in the young stage.

The pinnate leaves are from 10 to 12 feet long with drooping segments about 3 feet in length, the plant in general appearance somewhat resembling *Euterpe edulis*.

This plant has long been known here under this name, but in 1916 specimens were forwarded to Kew for determination when the authorities there whilst agreeing that the photograph, male inflorescence and leaves agreed with *B. nicobarica* found that the seeds resembled a species of *Oenocarpus*.

Borassus flabellifer, Linn., PALMYRA PALM. Trop. Africa and Asia.

This palm is extensively cultivated in parts of India and northern Ceylon growing to a height of 70 to 80 feet or sometimes even more with a trunk about 2 feet in diameter. It thrives best in dry localities. The fan shaped leaves are from 8 to 10 feet broad consisting of 70 to 80 leaflets which in old trees are packed in a dense head at the summit of the trunk.

A handsome group of these palms, planted about 1901, are to be seen in the Experiment Station in a low situation, which is more or less a swamp during the rainy season.

It is one of the most useful palms of India. The wood of the trunk is hard and durable, the leaves used as thatch and as ola or writing paper. Fibre is obtained from the leaves, toddy from the inflorescence and the fruit and young seedlings are used as food. Matting, bags, baskets, umbrellas, fans, &c., are also prepared from strips of the leaves.

Calamus Rotang, L. RATTAN. India and Malaya.

A climbing palm with slender stems growing to a great height and producing numerous suckers at the base. The stems and petioles are strongly armed with dark coloured spines. The leaves are from 5 to 6 feet in length; the pinnæ measuring from 12 to 18 inches in length and about 4 inches in breadth are furnished with slender spines produced on the margins and main veins. The prettily marked fruit are borne in clusters.

It is one of the sources of Rattan canes which are used for a great variety of purposes, *e.g.* for chairs, baskets, and other cane furniture, walking sticks, &c.

Caryota mitis, Lour. FISH TAIL PALM. Burma to Malaya.

A thick bushy spineless palm with numerous stems, 25 to 30 feet high with bipinnate leaves. The leaflets are wedge shaped, broad, and jagged, like a fish's tail, the outer angles usually being prolonged. The flowers are of different sexes borne on the same spike or occasionally on distinct ones, and followed by long pendant bunches of purple fruit from two or three feet in length. The individual fruit is about the size of a marble and the pulp of it is very acid.

Caryota urens, L. WINE PALM. TODDY PALM. FISH TAIL PALM. India and Ceylon.

A tall palm, growing to a height of 50 or 60 feet, with bipinnate leaves 18 to 20 feet long, the bases of which form sheaths around the stem, leaving scars when they fall. The pendulous inflorescences are from 10 to 12 feet long, consisting of a number of equal branches. These are produced in descending order when the tree is fully grown, the oldest at the top and the younger lower down in the axils of the old leaves till the tree finally becomes exhausted and dies. The fruits are about the size of nutmegs and have a yellow acrid rind.

Toddy or Palm Wine is obtained by fermenting sap drawn from the flower spikes; sago from the starchy portion of the trunk, and a black fibre known as Kittool fibre used for making ropes, brushes, brooms, baskets, etc., from the bases of the leaves.

Chrysalidocarpus lutescens. Wendl. Madagascar.

One of the most popular and ornamental of palms, branching at the roots to form numerous stems which grow to a height of 10 to 20 feet. The long pinnate leaves are bright green with yellow petioles. This plant is largely grown in pots, etc., in many countries for decorative purposes, and is very common in Trinidad. It is often called by its former name of Areca lutescens.

Cocos amara Jacq. West Indies.

One specimen of this lofty palm, 60 feet high, is to be seen in the Botanic Gardens and several in the Experiment Station. The stem is erect about 10 inches in diameter bearing a crown of drooping pinnate leaves with linear acuminate segments. The fruit is about the size of a hen's egg, of a bright yellow colour turning to brown when dry.

Cocos nucifera, L. COCONUT. Tropics generally.

A most important Palm of great economic value, widely cultivated in most tropical countries where it thrives best near the sea coast. It varies in height from 50 to 100 feet the trunk often being curved. The pinnate leaves are from 15 to 20 feet in length with pendant apices and numerous long narrow sharp pointed leaflets, the bases being surrounded with net-like brown fibre. The inflorescense is monoecious producing fruits in bunches of from 12 to 20 closely packed together.

Its uses are numerous but its chief value is for the production of Coconut oil. This is extracted from the kernel of the nut which is usually taken out, dried, and shipped in the form of copra, the oil afterwards being extracted by pressure. The refuse cake is valuable food for cattle. Coir fibre, obtained from the fibrous husk, is used for coconut matting, cordage, ships' cables, mattresses, etc. The leaf bud is used as a vegetable; the older leaves for thatching, mats, baskets, etc. The outer portion of the trunk is used in the building of houses, and toddy can also be obtained from the flower spikes. Desiccated coconut obtained from the kernel of the nut is also largely used.

Cocos plumosa, HOOK. Brazil.

A most attractive palm 30 to 40 feet high with circular markings arcund the stem, and plume-like, dark green leaves from 12 to 15 feet in length. The orange coloured fruits are very sweet and sticky, and much liked by the native children.

Cocos Weddeliana, WENDL, Brazil.

This palm is probably the most handsome of the Cocos family with its slender erect stems 4 to 7 feet in height and graceful pinnate leaves with narrow leaflets rich green above and glaucous beneath. This is one of the best plants for decorative purposes when grown in pots and is largely grown in many countries. In the Botanic Gardens there are only young plants, which have to be grown under shelter as they seem to dislike the heavy rainfall.

Coleospadix oninensis, BECC. New Guinea.

Plants of this palm have been raised from seed received from Singapore Botanic Garden in August 1916.

Corypha australis, R. Br.—See Livistona australis.

Corypha elata, Roxb. Tropical Asia.

A lofty Palm, 70 to 80 feet high, most ornamental when young. The palmate leaves are form 8 to 10 feet broad, more or less erect with petioles from 8 to 12 feet long having black margins and curved spines. The palm produces a terminal head of flowers about equal to the spread of the crown of leaves. The leaves then droop and die, leaving later the stem surmounted by a huge much branched fruiting spray. After the fruits ripen the tree dies.

Corypha umbraculifera, Linn. TALIPOT PALM. Ceylon and Malabar Coast.

An erect growing palm with a trunk reaching to a height of 70 to 80 or even 100 feet surmounted by a crown of fan like leaves, which are from 10 to 20 feet broad, almost forming a circle composed of 90 to

100 radiating leaflets, united except near the edges. The prickly petioles are from 6 to 7 feet long. The terminal pyramidal infloresсense is from 10 to 20 feet high. Dr. Trimen says " It is the largest and most imposing of Eastern palms flowering when about 40 years old." The seeds are round and hard about the size of marbles. After fruiting the tree dies. Two large specimens, and several small ones are in the palm collection.

The leaves are used for a variety of purposes, thatching, umbrellas, and tents, because of their strong and waterproof properties, also used by the Sinhalese as a substitute for paper. The ivory like seeds are made into buttons and various ornaments, and the young fruit when pounded are used for stupefying fish.

Cyrtostachys Renda, Blume. var *Duvivierianum*, Pynaert. SEALING-WAX PALM. Malaya.

A very handsome palm of medium height, producing, numerous suckers at the base. Leaves bifid, grayish beneath, with brightly coloured petioles and leaf sheaths which form the chief attraction of the plant. Only three small specimens are in the Botanic Gardens where it seems somewhat difficult to cultivate, although at Mr. Eugene André's nursery at Dabadie it grows freely in very heavy soil. Mr. André has now quite a large stock all of which he has raised by suckers from one original plant which is still to be seen in thriving condition.

Deckenia nobilis, Wendl. SEYCHELLES CABBAGE PALM. Seychelles Island.

Seeds of this palm were received from the Seychelles in 1913, and a good stock of plants have been raised and planted out. The leaves are pinnate, the petioles and leaf sheaths being thickly armed with long yellow spines.

Desmoncus major, Crueg. LATTAN (Tobago). Native.

A strongly armed climbing Palm with a slender flexible stem, and pinnate leaves consisting of about 20 pairs of segments, which are from 8 to 12 inches in length and 2 to 3 inches in breadth acuminate at each end, and armed with a few long sharp spines on the upper and under sides of the mid rib. The upper pairs of leaflets on the older leaves develop into hooks to assist the plants in attaching itself to trees. The flower spikes are branched, the male flower being above and the females below. The fruit is small, round and red when ripe.

The mature stems are used for basket making, etc.

Dictyosperma album, Wendl. and Drude. Madagascar.

An erect palm growing to a height of about 30 feet with a diameter of 8-9 inches. It can be readily distinguished by the whiteness of the spadix and infloresence, and the whitish petioles. Leaves pinnate 9 to 12 feet in length with a short channelled petiole.

The young inflorescense is enclosed in a large spathe 3–4 feet long which falls off as the flowers expand. Fruit purple ovoid about ⅝ of an inch in length containing an unsymmetrical seed with irregular markings.

Dictyosperma aureum, Wendl. and Drude. Hab?

Seeds of this palm were received in March 1916 from Dr. Stone, Florida, who had imported them from Rodriguez Island; from these seedlings have been raised, which in the young state make charming decorative plants. Bailey describes it as follows "Distinguished by the yellow or orange petioles and veins of young plants, caudex about 30 feet high, smaller and more slender than D. alba. Lvs 4–8 feet long, petioles 8 inches long, segms 1½-3 feet long 1 inch wide, secondary veins scarcely visible, branches of the spadix rigidly erect 9–11 inches long."

Dictyosperma rubrum, Wendl and Drude. PALMISTE ROUGE. Hab?

This palm grows to a height of about 30 feet with a trunk 8 to 9 inches in diameter, having corky spiral ridges where the old leaves were attached. Leaves pinnate 6 to 9 feet in length, with prominently ridged petioles of about 18 inches, and sheaths encircling the stem for 3 or 4 feet. Leaflets about 2 feet long usually adhering at the tips, even on the old leaves. The fruit is about half an inch in length borne on erect many branched spikes about 18 inches long. In young plants the leaves are darker green with the primary veins and margins dark red, the redness however disappears very much in adult plants. As a pot plant in its young state it is very attractive.

Didymosperma nanum, W. & D. Assam & Khasi Mountains.

This plant seems very much at home in the Gardens where it flowers and fruits freely. It is among the most dwarf of Palms, very old specimens here measuring but four feet in height. The leaves are pinnate with segments, alternate, and thinly dispersed. Segments broad and jagged somewhat resembling Caryota. Fruit purple, oval, about ½ an inch in length, containing two hard brown seeds with vein like markings.

Diplothemium caudescens, Mart. WAX PALM. Brazil.

An erect palm with a stem 12 to 20 feet high and about 10 inches in diameter. Leaves pinnate 12 to 15 feet long, shortly petioled, the rachis grooved at the lower end and keeled above. Segments very numerous arranged opposite each other, the middle ones about 2 feet in length with the upper and lower ones shorter, under surface densely glaucous, and the apex obtuse. Mid-rib stout and prominent above. This palm is now fruiting in the Gardens for the first time on record.

Elaeis guineensis, Jacq. OIL PALM. Tropical Africa.

A most important economic palm with a stout erect stem 40 to 50 feet in height crowned with a dense head of leaves, found abundantly in West Africa. The shiny pinnate leaves grow to a length of about 15 feet with more or less drooping leaflets, and petioles armed with stout spines. Male and female flowers are usually borne on distinct spikes and generally on different trees, the latter bearing dense heads of orange yellow fruits. There are several fine specimens in the Botanic Gardens and an avenue has recently been planted in the St. Clair Experiment Station, the plants being raised from good varieties received from the Gold Coast in 1913, included in which are the varieties Abe-Dam and Abe-Pa.

From the fleshy fibrous outer layer of the fruit, the well known palm-oil is obtained which is chiefly used in soap and candle making. "Nut-Oil" is a white oil expressed from the kernels and used for making margarine etc. The cake after the oil has been extracted is a good cattle food. From the leaf a strong fibre is obtained and the kernels are sometimes polished and made into ornaments.

Elaeis melanococca, Gaertn. Tropical America.

Plants of this palm have now become established from seeds received from the Ancon Hospital, Panama, in October, 1912. Nicholson's *Dictionary of Gardening* describes it as follows. "This closely resembles the foregoing (*E. guineensis*), but is smaller with a somewhat decumbent habit, emitting roots from lower side of prostrate stem."

Erythea edulis, S. Wats. California.

Young plants of this palm have been raised from seeds received from Dr. Stone in March, 1916.

The following description is taken from the *Standard Cyclopedia of Horticulture*. "Leaves green not glaucous. St. 40-50 feet high 15 inches thick, with thick corky bark, sheaths fibrous, petioles stout, 1 inch wide plano-convex, unarmed on the acute margins, fibrous pubescent or glabrate above, ligule $\frac{3}{8}$ inches long, densely silky—tomentose; blade 3 feet, segms 70-80 at first tomentose, lacerate at the apex and fibrous on the edges spadices numerous, 5-6 feet long, branched, fruit shining black."

Euterpe edulis, Mart. ASSAI PALM. Tropical America.

A shade and moisture loving Palm with a slender stem growing to a height of 30 or 40 feet generally inclining. The fruits are edible and about the size of marbles, with a thin coating of fibrous flesh from which a nutritious beverage known as Assai is prepared by soaking the fruit in water; this is largely used by the inhabitants of Para.

Geonoma gracilis, H. Wendl. Costa Rica.

Young plants of this palm have recently been raised from seeds sent under this name. They have now been planted out and are about two feet high. The leaves are pinnate with several broad segments on either side.

Guilielma speciosa, Mart. PEACHNUT. PEWA. PUPUNHA. Venezuela and Guiana.

An erect palm with a slender trunk about 6 inches in diameter covered with bands of spines of varying length alternating with the leaf scars. It grows to a height of 20 to 30 feet bearing a tuft of handsome pinnate leaves from 4 to 6 feet in length. The leaflets and petioles are both spiny. The fruit is borne in dense clusters and are about the size of apricots reddish yellow in colour. Suckers are produced freely from the base of the plant. It is a curious sight to watch the plant when in flower to see how the old flowers are constantly being thrown off, falling in continuous showers.

The fruits are eaten boiled with salt or roasted, and the kernel has a sweet nutty flavour. They are also ground into flour and made into cakes. A beverage is also made by fermenting them in water.

Howea Fosteriana, Beccari. THATCH PALM. Lord Howe's Island

A few small specimens of this handsome palm, which is so largely grown as a pot plant in temperate countries, are under cultivation in the Botanic Gardens. They have rich shiny green pinnate gracefully arching leaves, which when full grown are recorded as being 8 to 10 feet long, and the trunk 40 to 50 feet high.

It is one of the best palms for pot cultivation.

Hydriastele Wendlandiana, H. Wendl & Drude. Tropical Australia.

Several good specimens of this palm are growing in the Botanic Gardens and the Experiment Station, where they fruit abundantly. In general appearance it is not unlike *Areca Catechu*, but can be readily recognized from that plant by its much smaller round scarlet fruit, which are a little larger than peas. The seed is strongly ribbed longitudinally. The leaves are several feet long with segments of varying length and breadth and denticulate at the apex.

Hyophorbe amaricaulis, Martius. Mauritius.

A strong growing palm described as reaching a height of 60 feet. Specimens planted 15 years ago in the Experiment Station, however, are at the present time only about five feet in height, but have developed the stout bottle-shaped trunks characteristic of the plant and have produced flowers and fruits. The leaves are pinnate 6 to 8 feet long with brownish petioles and narrow leaflets covered with chaffy scales. Fruit round about the size of marbles.

Hyophorbe Verschaffeltii, H. Wendl. Mauritius.

An elegant palm with a smooth stem 20 to 30 feet high and 8 to 12 inches in diameter. Leaves pinnate and arching 4 to 6 feet in length with petioles only a few inches long, and strong prominent mid-ribs. The largest leaflets measure about 2½ feet in length, and one inch in breadth. The top of the trunk is encircled for a distance of several feet with the green leaf sheaths, the large bunches of fruit arising close below them. Fruit oval, about half an inch in length and purple when ripe. An avenue planted in 1915 near the nursery in the Royal Botanic Gardens has now become well established.

Jubaea spectabilis, H. B. Chili.

Plants of this Palm have been raised from seed presented by Dr. G. F. Stone, of Punta Gorda, in March, 1916. The following description is taken from Nicholson's *Dictionary of Gardening*:—"Leaves pinnate, spreading, 6 to 12 feet long, pinnae 1 to 1½ feet long, about 1 inch wide, springing in pairs from nearly the same spot, and standing out in different directions; petioles very thick at the base inclosed in a dense mass of rough brown fibres. Trunk, when developed tall, straight bearing the crown of large leaves. Height 40 to 60 feet. The most southern of American Palms. From the sap obtained by felling the tree, boiled to the consistency of treacle, a syrup called Palm-honey is prepared, which is in considerable request in Chili."

Kentia Forsteriana, *F.* Muel. See Howea Forsteriana, Beccari.

Latania glaucophylla, Hort., *See* Latania Loddigesii, Mart.

Latania Loddigesii, Mart. Mauritius.

A handsome palm with an irregular stem 10 to 12 inches in diameter usually swollen at the base. The palmate leaves are from 3 to 5 feet in length, and very glaucous giving the whole plant a greyish appearance. Petioles 3 to 4 feet in length covered with a brownish scurvy substance and divided at the base. Staminate and pistillate flowers are borne on different plants, the former being long and pendant, the latter denser and more erect, producing pear-shaped fruit. Many fine specimens of this palm can be seen growing in various parts of the gardens.

Licuala grandis, Wendl. ROUND-LEAVED PALM. New Britain.

A handsome, shade loving palm of low growth, and bright green fan-shaped leaves about 3 feet in diameter and two feet in length. The margins are divided into obtuse bifid lobes about ¾ of an inch long. Petioles 2 to 3 feet, rounded below with two prominent ribs armed with short stout spines. The seeds are about the size of peas.

Licuala spinosa, Thunb. Java, Moluccas.

A slender many stemmed palm 10 to 15 feet in height with orbicular leaves composed of many widely separated lobes from 15 to 18 inches in length with obtuse many-toothed apices. Petioles almost triangular the two prominent ridges bearing brown hooked spines and fibrous basal sheaths. The flowers and fruit are borne on long erect spikes, the latter being about the size of currants, orange-coloured when ripe.

Livistona altissima, ZOLL. Java.

A very tall, erect, slender, stemmed palm exceedingly handsome, when carrying a good crop of scarlet berries. The palmate leaves are from 3 to 5 feet broad with petioles 4 to 5 feet in length and strongly armed.

Livistona australis, MART. AUSTRALIAN CABBAGE PALM. E. Australia.

Two specimens of this palm are growing in the gardens. They very much resemble *Livistona chinensis* with their drooping segments, but can be recognized by the longer and more erect petioles. As yet they have failed to fruit.

Livistona chinensis, R. BR. China and Japan.

A palm growing to a height of 50 or 60 feet with a grey trunk about 1 foot in diameter surmounted by a crown of palmate leaves, which measure about 5 feet in breadth. The narrow pendant leaflets are quite a characteristic feature of the plant and make it recognizable for a long distance. The petioles are about 6 to 7 feet long with two prominent ridges armed with retrorse spines which are more strongly developed on young plants. The fruits are about the size of marbles borne on arching branches. It was first planted in the gardens in 1883 and there are now many good specimens including a fine avenue in the Experiment Station.

This palm is largely grown for decorative purposes. Fans are made from the leaves and rope from the fibrous sheaths of the leaf stalks.

Livistona Hoogendorpii, HORT. Java.

A fine group of this handsome palm planted in 1901 is growing in the Experiment Station. The stem is stout and erect, bearing almost round rich dark green deeply divided leaves, on long rigid petioles which are strongly armed with stout recurved spines, and enclosed in a network of fibres at the base.

Livistona Jenkinsiana, Griff. TOKO PAT. Assam.

An erect palm 30 to 50 feet high, with a trunk 8 to 12 inches in diameter. The leaves are palmate, from 3 to 4 feet in length, and about the same in breadth. The petiole is flat on the upper surface and rounded beneath, the two prominent ridges being armed with short hooked spines for about half their length. The fruit are about 1¼ inches in diameter, of a deep blue colour enveloping seeds about the size of marbles.

In Assam the natives make use of the leaves for thatching and for making the peculiar umbrella hats worn in that country.

Lodoicea Seychellarum, Lab. *See* Lodoicea callipyge
Lodoicea Callipyge, Comm. DOUBLE COCONUT. COCO-DE-MER. Seychelles.

A most interesting palm growing to a height of 50 to 100 feet of which there is only one specimen in the Botanic Gardens. It is about 10 feet high and was raised from seed introduced in 1895 by Mr. G. S. Jenman of the Botanic Gardens, British Guiana. Seeds had also been sent in 1880 from Mauritius but failed to grow. The trunk is about a foot in diameter bearing a crown of very large fan shaped leaves. The following is an extract taken from the *Botanical Journal*. "The palm is chiefly notable, for the fact that it bears the largest known seed vessels and takes no less than three years to germinate. Staminate and pistillate flowers are produced on different trees, the former coming into bearing during their 45th year, the latter requiring 20 more years of growth before flowering. The nuts ripens in seven to nine years, it is usually 2 or 3 lobed and sometimes 6 lobed. Germination as may be imagined is peculiar. For some time—3 years at least, the seedling remains attached to the parent nut by means of an elongated cotyledon."

The shell is very hard and used for water vessels, baskets, fans, hats, and ornamental articles are made from the leaves, and walking sticks from the hard wood.

Manicaria saccifera. Gaertn. TIMITE. Native.

Young plants of this palm raised from seed brought from the Arima district by Mr. W. G. Freeman in April 1916, are now growing well. It is very common in Venezuela and recorded by Prestoe as being a well marked species on the wet gravelly flats of Trinidad. The 1 to 3 lobed fruits are borne in bunches, and is one of the characteristic drift fruits of the Eastern Coast.

This palm grows to a height of 15 to 20 feet with entire or sometimes divided leaves with a serrated upper margin.

The leaves are largely used for thatching, and the fibre from the spathes used in mat-making.

Martinezia caryotæfolia, H. B. & K. New Grenada.

A slender stemmed palm 20 to 30 feet high armed with rings of dark coloured spines, and bearing a few leaves on the summit. As it ages it is of little decorative value. Leaves pinnate about 5 feet long, the pinnæ not so long as those of *M. corallina*, and with a broader lobed truncate apex.

Martinezia corallina, Mart. Martinique.

A slender palm about 20 feet high, with stems thickly armed with long, black, needle-like spines. The pinnate leaves are from 5 to 6 feet in length, with wedge-shaped leaflets 16 to 18 inches long, broadest at the apex, and bearing a few spines. The petioles are about 2 feet in length covered with small spines as is also the rachis. Fruits globose, brilliant scarlet, about the size of peas.

Mauritia setigera, Griseb. MORICHE PALM. Trop. America and Trinidad.

A few specimens of various ages are growing in the St. Clair Experiment Station. In the vicinity of the Aripo Savannah and the Pitch Lake at La Brea it is however seen to the best advantage. It has an erect unarmed trunk growing to a height of about 40 feet. The leaves are palmate with deeply cut segments, 2½ to 3 feet in length, and about 1 to 1¼ inches in breadth. On the mid rib of the segments are found a few scattered weak prickles which appear to be by no means regular.

Maximiliana caribaea, Gr., and Wendl. COCORITE PALM. Native.

A lofty palm with an erect trunk, and immense leaves from 24 to 30 feet long. The leaflets proceed from the stalk in fours and fives at different angles, giving the leaf a plume-like appearance. The leaf stalks are shiny green, very sharp and jagged. The brown, pointed fruits are borne in dense hanging bunches, and protected by a large stiff woody spadix tapering off to a long point. The palm grows very rapidly and thrives in sandy and gravelly soils, and on dry barren hillsides. Its presence in abundance is usually an indication of poor soil.

Leaves used for thatching.

Oreodoxa Borinquena, Reasoner. PORTO RICAN ROYAL PALM.

A few specimens of this palm raised from seed received from Ancon Hospital Panama in 1915, are now established in the gardens. The following is taken from the *Economic Plants of Porto Rico*, by Cook and Collins. "The Royal Palm or *Palma real* is not only the more conspicuous and characteristic natural object in most parts of Porto Rico but it probably exceeds the coconut in total economic importance. The most useful part is the yagua, or sheathing base of the leaf with which a large proportion of the houses of the poorer classes are thatched, or sided, or both." L. H. Bailey in the *Standard Cyclopedia of Horticulture* describes it as follows; "Trunk usually with a prominent bulge, but sometimes slender, about 30 to 35 feet tall, otherwise much as in *O. regia* but differing in having a more densely branched inflorescense which is covered with a dark brown substance.

Seeds about ½ inch long, distinctly narrower than those of *O. regia* and somewhat flattened or concave on the back. Porto Rica on limestone hills."

Oreodoxa oleracea, Mart., PALMISTE. CABBAGE PALM. Native.

A lofty palm with a perfectly straight, almost cylindrical, unarmed trunk, sometimes reaching as much as 180 to 200 feet high.

This is a very handsome palm much used for avenue planting, the straight, grey trunks surmounted by the large crowns of pinnate leaves giving a noble effect. It is fairly common throughout Trinidad and Tobago.

A form of sago is obtained from the stem and the wood of mature stems is used for building huts. The leaf bud or "cabbage" is eaten. The leaf stalks are made into cradles for Negro children or used as splints for fractures. A kind of sago can also be made from the pithy portion of the stem.

Oreodoxa regia, H. B. & K. ROYAL PALM. Cuba and Panama.

This Palm is very similar to the Palmiste (*O. oleracea*), the most noticeable differences being the thinner leaflets, the more plume-like appearance of the leaves the lower of which droop instead of standing out horizontally as is usual with the Palmiste. The parts of this palm can be used as those of *O. oleracea.*

Phœnix acaulis, Buch. Burma.

A dwarf thick stemmed palm, 10 to 12 feet high, with long, spreading, pinnate leaves. Leaflets dark green, very rigid, and with a spire-like apex, those near the bases being developed into strong spines several inches in length. Grown as a pot plant it is very ornamental. This plant is well represented in the Botanic Gardens.

Phœnix canariensis, Hort. Canary Islands.

A palm somewhat resembling the Date palm (*Phœnix dactylifera*), but with a much larger and more graceful head of leaves, and a more naked stem. It is a very pretty sight when carrying a full crop of orange yellow fruits, the outer portion of which are edible.

Phœnix dactylifera, L. DATE PALM. S. Europe. N. Africa. S. E. Asia.

A handsome palm, 60 to 80 feet high, the old leaf-sheaths adhering to the stem. Leaves pinnate and erect, with strong sharp-pointed leaflets. The flowers are dioecious and Willis says "the Arabs fertilize the female spadix by hanging the male over it." Propagation is effected by means of the numerous suckers which develop at the base of the trunk. The plant produces a full crop at about 20 years and continue to bear to a great age. A special importation from Algeria was made in 1903, but the plants have made very poor growth in the Trinidad gardens, and so far failed to fruit. Better results were obtained in swampy land in the Tobago Station. In the Colony there are old trees, but the fruit is poor, and the climatic conditions appear unsuited for the cultivation of this palm as a source of good dates.

The fruit is the common food of the desert tribes of Northern Africa and the Sahara, and largely used for dessert in other countries. Huts and houses, are constructed of the wood, the fibre at the base of the leaves is used for making coarse cloth, and the stalks for baskets, brooms, walking sticks, etc. The young heart is sometimes eaten as a vegetable and the older leaves used for thatching purposes.

Phœnix humilis, Royle. var. *Rœbelinii.*

A few small plants of this useful decorative palm were recently presented to the Gardens by Mr. E. André, of the Dabadie Nurseries. The stem is short, bearing pinnate leaves, slightly glaucous on the under surface. This palm is a favourite pot plant in England.

Phœnix rupicola, T. Anders. India.

A palm, 15 to 20 feet high, producing one or more slender stems and long, pinnate, arching leaves. Leaflets drooping, long and narrow, the lower ones reduced to spines. A handsome palm when young.

Phytelephas macrocarpa, Ruizet. Pav. IVORY NUT PALM or COROZO NUT. Colombia.

This palm thrives best in moist situations. It has a short prostrate stem bearing handsome, erect, pinnate leaves often measuring as much as 20 feet in length. Male and female flowers are borne on different plants. The spiky fruits form an aggregation of drupes borne in globular clusters about the size of a man's head. This palm has become quite established in the Nutmeg ravine in the Botanic Gardens, but only fruits at rare intervals.

The hard seed known as Vegetable Ivory, is chiefly used as a substitute for elephant Ivory, and manufactured into billiard balls, spindles, toys, buttons, chess men, etc. Thin shavings are used for snow flakes in theatres.

Pinanga Kuhlii, Blume. Malaya.

Two specimens of this plant are in the Palm collections. They have slender stems which when full grown attain a height of 20 to 30 feet, and produce numerous suckers at the base. The leaves are pinnate 3 to 4 feet in length with leaflets 1 to 2 feet in length sub equally cuneate at the base, the upper ones truncate at the apex, and with several strong ribs. The petiole and sheath is somewhat scurvy and of a greenish-yellow colour.

Pritchardia pacifica, Seem and Wendl. Pacific Islands.

This palm is well represented in the gardens, and is readily recognized by its large, plaited, palmate leaves which when young are covered with a white downy substance as are also the petioles. When full grown the trunk is about 30 feet high straight and smooth. The fruit are round and black borne in dense heads.

Pritchardia pacifica var longi pedunculata is also in the palm collections. On this plant the fruit are borne on long peduncles which hang down below the level of the leaves.

Pritchardia Thurstoni, Drude. Fiji.

This palm has been added to the collections by seeds received from British Honduras in July, 1916, seedlings from which have been successfully raised.

It is described as a tall palm, with palmatisect leaves borne in a crown at the top of the stem and slender flower stalks bearing compact panicles of flowers.

Ptychosperma Macarthurii, H. Wendl. Australia.

A palm of medium height, producing many slender spineless stems one to three inches in diameter, showing circular markings. Leaves pinnate 5 to 7 feet in length, with leaflets measuring 1 foot in length and 1 to 2 inches in breadth, with the apex obtuse and jagged. The small pale yellow slightly scented flowers are borne on many branched spikes, followed by an abundance of small brilliant scarlet fruits. The seed is ridged longitudinally.

Ptychosperma Sanderiana, Ridley. N. Guinea.

Plants of this palm have been raised from seed received from the Singapore Botanic Gardens in August, 1916. The following is an extract from a description by H. N. Ridley, in the *Gardeners' Chronicle*, 1898, 11·330:—"It has a stem from 10 to 15 feet high and 1 inch in diameter with tolerably regular points 1 to 3 inches long, the leaves over 4 feet long with a rather slender rachis, which, especially at the base, is covered with a flocculent brown tomentum, the pinnæ are alternate, over fifty on each leaf, narrow, linear, a foot and a half long, and half an inch broad, tapering towards the point, and another much shorter with a deep notch between them. The panicle hangs below the leaves, rather large and many branched, the branches stout, 8 inches or more in length, the rachis is sprinkled with brown fur, like that of the leaves."

Raphia pedunculata, Beauv. Madagascar.

Only young plants are in the Trinidad collections raised from seed received from fruiting specimens in the Botanic Station, Tobago. It grows from 25 to 30 feet in height. The fruit are polished chestnut brown in colour, about the size of a hen's egg or a little larger with a depressed apex, and the outer covering composed of 12 to 15 rows of scales. Hundreds of fruits are borne on a single bunch.

Raphia Ruffia, Mart. See R. pedunculata Beauv.

Rhapis flabelliformis, L. Herit. GROUND RATTAN PALM. China and Japan.

A palm 6 to 8 feet high with slender flexible stems produced in great abundance and clothed with fibrous sheaths which, on falling away, expose a green stem with distinct circular markings about ½ to ¾ an inch apart. Leaves palmate, about 12 to 18 inches long and divided into 12 to 15 segments, the apices of which are deeply divided into 4 or 5 lobes. Petioles about twice as long as the leaves, flat above and roundish beneath with two prominent ribs.

The plant is very useful for hedges, fine examples of which can be seen in the Gardens. Partridge cane walking sticks are made from the stems.

Sabal glaucescens, Lodd. Native.

Tall growing palms with deeply cut fan shaped leaves 7 to 8 feet long. Segments 4 lobed, deeply divided and glaucous beneath. Petiole about the same length as the leaves. In the ravine north east of Government House, a group of this handsome palm ca be seen.

Sabal Palmetto, Lodd. CABBAGE PALMETTO. Southern U.S.A.

Seedlings of this palm were raised from seed brought by Mr. W. G. Freeman, from Barbados in December, 1915, from a plant which had recently been determined at Kew. Bailey says "it grows to a height of 20 to 80 feet, with leaves 5 to 8 feet long recurved at the summit, shorter than the petiole, segments deeply cleft."

The leaves are used for thatching and making into hats and the trunks make goods piles for wharves.

Sabal sp.

By the main entrance to the gardens is a pair of handsome palms bearing large heads of leaves on long petioles which stand out straight from a trunk thickly clothed with the old leaf sheaths.

The *Gardeners Chronicle* II, 1887, 625, gives an illustration of one of the same kind taken in the Trinidad Botanic Gardens, and quotes it as closely resembling *Sabal Blackburnianum*.

Sabal sp. (? Sabal acaulis, Hort.) STEMLESS PALM.

Two specimens of this palm are under cultivation in the Botanic Gardens. They have palmate glabrous leaves two to two and a half feet long. The leaflets are closely plaited and united for about half their length with very stiff ridges. Petioles 3 to 4 feet long, smooth, concave above and convex beneath.

Sabal umbraculifera, MART. PALMETTO ROYAL. Native.

An erect palm with a stout columnar trunk 1 foot or more in diameter, and 60 to 80 feet in height. The large orbicular leaves form a dense head at the summit of the trunk, the lower ones usually lying flat against it. Leaflets long and narrowed to a very fine point. The small black fruits are borne in great abundance on long arching spikes which often develop some distance above the crown of leaves.

Boards from the trunk are used in Jamaica to build native huts. Brushes are made from the thick fibre of the wood and mats, hats, baskets, etc., from the leaves.

Seaforthia elegans, HOOK. *See* Archontophœnix Cunninghamii.

Stevensonia grandifolia, Duncan. Seychelles.

A handsome palm, the stem reaching to a height of 50 feet, and 1 foot in diameter, in its native habitat. The leaves are entire (or divided in older specimens) mottled with reddish brown, and with a bifid apex. Strong spines thickly clothe the leaf-stalks. The fruit are about half an inch in length, scarlet when ripe. Seeds irregularly marked, little smaller than the fruit ¼ of an inch in diameter at the broadest part and narrowed to a point at the apex.

This palm somewhat resembles *Verschaffeltia splendida*, but it can be readily recognized by the much finer deeply cut bi-lobed pinnæ, the stronger spines, the absence of the stilt-like roots so characteristic a feature of Verschaffeltia and the small conical fruits. It was first planted in the gardens in 1883.

Thrinax argentea, Lodd. SILVER THATCH PALM. BROOM PALM. Native.

A slender, stemmed erect, unarmed palm of medium height. Leaves palmate about 4 feet broad, glaucous beneath, the segments uniting at the base where an orange coloured papilla is formed on the upper surface. Petioles 3 to 4 feet long, with two prominent ribs on either side, and enveloped at the base by a brown netted fibre.

Flower spikes arching 2 to 3 feet in length, bearing small white fruit.

The fibre is used for making hats, baskets and fancy articles, and the undeveloped leaves are sometimes eaten as a vegetable. In Panama brooms are made from the leaves, hence the name of Broom Palm. Young specimens of this palm are good pot plants.

Thrinax floridana, Sargent. Florida.

An elegant slender palm, 12 to 15 feet high, with stiff, light green, palmate leaves. Segments broader than those of *T. argentea*, bifid at the apex and united at the base, where a pale green papilla is formed. Petioles 2-ribbed about twice the length of the leaves, and surrounded at the base by fibrous sheaths. The fruits which are about the size of peas, are borne on pendant branches. As a pot plant it is not so graceful as *T. argentea* the leaflets being more rigid.

Thrinax Morrisii, H. Wendl. Anguilla. W. Indies.

A dwarf palm, only growing to a height of 3 or 4 feet, with fan-shaped leaves about 3 feet in diameter slightly glaucous beneath; segments about one and a half inches broad divided to about half their length when they gradually taper off to a sharp bifid apex. Petioles 3 to 4 feet in length flat and 2 ribbed. The fruits are white scarcely ¼ of an inch in diameter, and borne on erect spikes which often grow out beyond the leaves.

Mats are made from the leaves.

Trachycarpus excelsus, H. Wendl. CHINESE COIR OR HEMP PALM. China and Japan.

Young plants of this palm have been raised from seeds sent by Dr. Stone of Florida. Its principal use is in making brushes and rope. Nicholson's *Dictionary of Gardening* gives the following description "f. spadix 1 ft. long duplicately branched spathes membranous fuscous, tubular bifid at apex. Leaves in young specimens oblong, in adults transversely oblong concave, digitately multipartite, 1½ ft. in diameter, segments 15 to 60, linear somewhat obtuse, bidentate or shortly bifid, the teeth or segments obtuse, petioles above loosely concave, below convex 1½ ft. long, the margins smooth or armed with small teeth, height 24 feet.

Verschaffeltia splendida, H. Wendl. Seychelles.

A slender stemmed Palm growing to a height of 60 to 80 feet, the trunk being raised on stilt roots and spiny towards the summit. Leaves broad and entire with reddish stalks, serrated edges and bifid apex, the sheath being thickly armed with slender spines. In old specimens the red colour of the stalk is less evident, the plant is less spiny and the leaves are more divided. When young they make handsome decorative plants.

Wallichia disticha, T. Anders. Sikkim Himalaya.

This most interesting species is represented in the Gardens by two plants, the tallest of which is from 20 to 25 feet high. It is remarkable for the fact that the large pinnate leaves are arranged in two straight rows on either side of the trunk as in the Travellers' tree, (*Ravenala.*) The leaflets are wedge shaped, with a jagged apex.

Washingtonia filifera, H. Wendl. WEEPING PALM. California.

Plants of this Palm have been raised from seed presented by Dr. G. F. Stone of Florida in March 1916.

Bailey in his *Cyclopedia of American Horticulture* gives the following description. " Stem cylindrical 20–40 feet enlarged at the base (2–3 feet) covered with persistent petiole basis; petioles 2–5 feet long, 1–2½ inches wide at the summit, glabrous plano-convex, glabrous, lacerate, blade circular, tomentose on the margins of the 40–60 segments 3–5 feet in diameter, cleft on the upper side nearly to the middle, grey green, segments margined with numerous fibres 6–12 inches long. *Washingtonia filifera* is perhaps the most characteristic palm of California. Its immense straight bole and shaggy collar of deflexed dead leaves make a striking and picturesque object. This collar of old leaves usually burns fiercely in the dry season."

CASTOR OIL SEED.

The following Circular has been issued by the Department of Agriculture:—

The Castor Oil plant or *Palma Christi* is well known and is to be found in almost every part of the Colony, in gardens, waste lands, etc. In India, it is cultivated on a large scale for the sake of its seeds which are the source of Castor Oil. This oil is used in medicine, for illuminating purposes, for preserving leather, and as a lubricant for machinery. India and Brazil have long had almost a monopoly of the trade in castor oil seeds, the comparatively low price obtained for which in the past has prevented other countries from producing it profitably. Recently however the price of the seed has risen very much. This, as has been pointed out by M. Paul Serre, the French Vice-Consul in this Colony, is due largely to the increased demand, owing to the war, of oils suitable for engines of aeroplanes, motor cars, etc., etc. Castor Oil is one of the best for this purpose.

In the past there has been no ready local market for Castor Oil seeds, in lots such as the small cultivator could produce, and the crop has not been one which offered attractions to the large proprietor as he could use his land to greater advantage.

Now, however, things are changed. Our armies need the oil, the price has gone up, and arrangements have been made to buy the seed locally so that anyone with only small quantities to sell can get full value for it on the spot.

Varieties: There are several kinds, the two chief being one with large and the other with small seeds. Both are useful.

Cultivation: The Castor Oil plant does well on ordinary land, but best in light soil rich in vegetable matter. It grows very well in new cacao and coconut cultivation, contracts, gardens, etc., and is very useful as a temporary shade for young cacao. It can also be grown by the sides of traces, in any open spots in cacao, coconuts, etc., or waste corners.

Sow two or three seeds in holes about five or six feet apart. The large seeded kind wants more room than the other. About 8 to 10 lb. of seed are enough for an acre.

Pinch off the tops when the plants are about 18 inches high so as to make them branch. Whilst young keep the land round free of weeds and grass.

Reaping: The plants will begin to bear in about 6 months and go on bearing for one or more years according to the kind. Pick the bunches of pods before they open or the seeds will be lost. Pile them up in a heap under a shed and cover with trash, when the shells are soft expose to the sun for two days; many will split open, if they do not, beat with sticks until the seed separates out. Another way is to put the ripe bunches of pods in a cacao basket, cover with another basket upside down and place in the full sun. The pods split open and throw out the seeds, which the basket on the top prevent from being lost.

SALE: The Ground Provisions Depôt will purchase for cash well cleaned and dry seed, in small or large lots, for the French Consul. The buying arrangements will be the same as those for ground provisions, and the prices will be advertised in the newspapers.

It is expected that it will be possible to give about three cents a pound for the seeds. A single plant should yield about a pound of seed a year, so that five Castor Oil plants will give as much return as an average cacao plant.

Seed for sowing will be supplied by the Department of Agriculture as soon as available at two cents a packet, or 5 cents a pound.

W. G. FREEMAN,
November, 1917. *Acting Director of Agriculture.*

Dracontium gigas.—A plant of this strange-looking Aroid opened its spathe in the Orchid House of the Royal Botanic Gardens on December 14, 1917, and has attracted quite a considerable number of visitors to see it.

Whilst it certainly cannot be regarded as pretty, and its odour is far from sweet, the huge flower makes quite an interesting addition to the collections. It is figured in Plate No. 6048 of the *Botanical Magazine*, (1872) and described by Sir J. D. Hooker as *Godwinia gigas* which the *Index Kewensis* refers to as *Dracontium gigas.*

It has a tuberous root with an erect mottled green and yellow petiole 8 feet high and 8 inches in circumference reaching to the top of the Orchid House. The single leaf has three primary divisions which are again deeply incised, the whole being almost circular in outline with a diameter of 6 feet. The spathe is 2 feet in length with a circumference of 16 inches at its widest part tapering to 6 inches at the base. It is hooded with a gaping aperture open for about one-third of its length. In colour it is very dark brown getting paler till it reaches an almost greenish yellow at the base. This huge structure is borne on a peduncle 15 inches in length and 5 inches in circumference with dark brown and white markings, and emerges from near the base of the petiole.

Hooker in the *Botanical Magazine* describes it as a native of the Chontales Mountains of Nicaragua, where it was discovered by Dr. Seemann in 1869, growing amongst brushwood in rivulets and named by him after Mr. George Godwin, F.R.S., an eminent architect.

Is is occasionally seen under cultivation and the writer had the privilege of seeing a fine specimen flowering in a pan at the Victoria regia house at Kew in 1915.

R. O. W.

METEOROLOGY.

RAINFALL RETURN OCTOBER TO DECEMBER, 1917.

Stations.	October.	November	December.	Jany. to Dec., 1917	Jany, to Dec., 1916
North-west District.	Ins.	Ins.	Ins.	Ins.	Ins.
St. Clair—Royal Botanic Gardens	5·43	6·61	8·22	64·24	69·73
Port-of-Spain—Colonial Hospital	3·83	4·73	9·03	55·92	53·70
,, Royal Gaol	3·73	5·46	7·06	56·87	57·98
,, Constabulary Headquarters	4·28	6·47	6·49	54·75	60·45
St. Ann's—Reservoir	8·09	7·63	7·88	80·76	75·17
Maraval— ,,	9·75	8·49	6·30	74·98	84·08
,, Constabulary Station	8·58	9·01	9·40	86·78	83·49
Diego Martin—Constabulary Station	8·15	7·91	5·55	86·18	84·80
,, Waterworks	8·77	5·52	4·61	74·56	75·62
,, River estate	8·34	5·43	5·83	69·91	74·32
Fort George Signal Station	7·60	6·77	5·86	63·80	71·40
North Post ,,	4·72	5·15	4·59	57·14	61·54
Carenage Constabulary Station	10·06	8·39	5·96	79·59	88·82
Carrera Island Convict Depôt	2·01	2·32	2·34	22·53	55·47
Chacachacare Lighthouse	4·10	4·90	3·17	51·22	45·68
Santa Cruz—Maracas District.					
Santa Cruz—Constabulary Station	8·12	9·22	9·66	96·00	88·35
St. Joseph—Government Farm	3·63	5·77	9·14	64·63	53·83
,, Constabulary Station	2·18	4·85	7·37	56·77	48·62
Tunapuna—St. Augustine estate	3·55	5·67	10·51	58·30	50·12
Maracas—Government School	5·48	8·09	7·31	81·72	89·21
,, Ortinola estate	5·10	6·26	8·64	75·85	81·16
,, San José estate	...	6·24	6·81	...	...
Caura—Wardour estate	6·17	7·47	5·63	66·62	64·65
West Central District.					
Caroni—Frederick estate	3·58	7·94	9·38	61·40	55·66
Chaguanas—Constabulary Station	4·41	4·90	5·85	60·78	56·13
,, Woodford Lodge estate	5·55	5·82	5·69	54·96	55·85
Carapichaima—Waterloo estate	4·18	8·53	7·55	64·44	66·04
,, McBean Cacao estate	3·86	5·89	7·55	56·59	...
,, Friendship Hall estate	3·70	10·00	...	...	39·36
Couva—Exchange estate	2·11	7·04	8·08	56·86	53·61
,, Brechin Castle estate	2·83	8·46	10·18	63·41	63·68
,, Perseverance ,,	1·71	5·84	...	...	58·82
,, Camden ,,	2·53	6·38	8·38	53·61	50·86
,, Milton ,,	2·22	7·40	14·63	68·34	71·64
,, Spring ,,	3·38	7·97	10·51	68·69	62·21
,, Constabulary Station	2·72	8·23	9·56	45·57	59·65
,, Esperanza estate, Savonetta	2·90	6·63	11·12	57·56	60·83
Montserrat District.					
Brasso-Piedra—Mamoral estate	5·75	10·05	13·49	91·85	...
,, La Mariana estate	6·44	8·74	14·40	88·17	...
Montserrat Constabulary Station	2·89	8·98	11·37	66·11	63·83
Brasso—La Vega estate	6·14	11·87	13·30	92·86	76·70
Arima District.					
Arima—Warden's Office	6·03	6·77	5·12	...	63·95
,, Torrecilla estate	5·87	8·63	7·08	86·56	80·05
,, Verdant Vale estate	5·49	9·56	7·24	82·43	84·59
San Rafael—Constabulary Station	8·25	10·24	12·02	94·62	8·124
Guanapo—Talparo estate	6·03	9·51	13·62	101·57	75·13
,, San José Estate	8·37	12·70	18·42	108·73	95·24
Tamana—Sta. Marta estate	8·42	11·31	26·62	127·64	102·38
,, La Corona estate	8·21	9·43	19·06	109·39	119·47
San Fernando & Princes Town District.					
Claxton's Bay—Forres Park estate	2·10	7·29	10·10	55·34	65·25
Pointe-à-Pierre—Bonne Aventure est.	2·89	8·91	8·11	62·27	59·39
,, Concord estate	3·55	8·92	8·56	69·43	61·41
,, Plein Palais estate	2·90	7·26	7·05	65·36	53·87
Naparima—Picton estate	3·03	7·74	5·36	66·11	62·00
,, Usiné St. Madeleine	3·85	7·20	5·84	61·56	59·65
,, La Fortunée estate	4·21	5·34	3·17	61·19	56·67
,, Lewisville	4·16	7·25	7·11	78·64	69·41
,, Tarouba estate	2·19	5·52	3·96	53·18	44·47

RAINFALL RETURN—OCT. TO DEC., 1917.—CONTINUED.

Stations.	October.	November.	December.	Jan., to Dec., 1917.	Jan., to Dec., 1916.
San Fernando and Princes Town District.—(*Contd.*)	Ins.	Ins.	Ins.	Ins.	Ins.
Naparima—Union Hall estate	3·96	6·31	6·31	70·81	58·78
,, Palmiste ,, ...	3·99	6·65	6·22	81·98	66·60
,, Hermitage ,, ...	3·25	5·46	5·30	63·45	55·69
,, Petit Morne ,, ...	2·51	7·49	5·31	58·27	56·10
Princes Town—Craignish estate	2·75	10·79	6·99	57·12	65·95
,, Cedar Hill estate . ..	3·93	8·53	9·25	67·67	61·83
,, Williamsville estate . ..	3·00	10·09	7·25	59·80	70·54
,, Esmeralda estate	3·57	9·94	8·71	73·07	61·91
,, New Grant estate . ..	3·31	11·42	9·05	70·29	71·27
,, Constabulary Station .. .	3·46	10·00	6·83	56·84	58·71
,, Hindustan estate	3·95	9·61	6·75	69·45	70·01
,, La Retraite estate	4·92	14·31	9·72	93·95	99·38
,, Malgretoute estate	3·84	9·93	6·68	64·91	69·79
,, Los Naranjos estate	3·80	9·30	8·11	72·39	.
,, Friendship & Ben Lomond estates .	3·70	9·32	7·04	66·62	68·80
Poole—El Rosario estate	7·96	14·92	12·30	99·21	89·58
South-west District.					
Oropuche—Constabulary Station	9·68	7·82	5·51	78·68	62·96
,, Pluck estate	5·37	6·27	5·97	61·97	59·17
Siparia—Constabulary Station	4·27	7·75	7·88	74·98	62·98
,, Alta Gracia estate	4·97	8·03	9·33	76·67	68·82
Guapo—Adventure estate	5·46	9·58	5·66	80·38	64·11
Cap-de-Ville—Constabulary Station . ..	8·07	10·76	5·25	96·35	78·29
Erin—La Ressource estate	2·05	5·80	4·01	64·30	45·29
,, Industry estate	3·40	7·38	4·02	71·21	55·68
,, La Union estate	2·85	6·36	4·65	69·56	...
Cedros—La Retraite estate	9·61	11·34	4·92	94·94	84·49
,, Beaulieu estate	2·96	4·30	4·92	66·10	56·48
,, St. Marie estate	2·37	4·39	4·02	72·44	56·76
,, St. Quintin estate	0·86	7·34	3·36	65·01	..
,, Constabulary Station	1·98	4·87	4·25	71·09	59·24
,, Perseverance estate	1·59	3·60	3·48	69·68	59·15
Icacos—Constance estate	2·85	5·25	15·09	134·59	76·22
Irois—Government School..	4·26	5·79	2·87	87·54	72·01
South Coast.					
Moruga—Constabulary Station	5·05	8·06	6·71	73·47	75·96
East Coast.					
Matura—La Juanita estate	7·63	8·20	21·70	106·55	82·85
Manzanilla—Constabulary Station	7·24	10·26	31·06	122·23	88·40
,, Indrasan estate	11·67	12·46	28·24	.	.
,, San Francisco estate . ..	18·91	13·67	30·75	.	.
Sangre Grande—New Lands estate	1·72	15·19	21·74	121·50	88·94
,, Evasdale estate	9·68	12·79	22·34	111·55	98·39
,, Grosvenor estate	11·84	12·76	26·78	126·99	99·42
,, San Hilario estate	7·56	12·67	21·73	105·83	81·59
Mayaro—Constabulary Station	5·06	11·93	17·32	89·80	85·02
North Coast.					
Blanchisseuse—Constabulary Station	3·05	6·50	7·43	83·27	85·51
Grande Rivière—Mon Plaisir estate	6·83	11·83	10·62	96·62	108·49
Toco—Aragua House	3·14	10·03	9·92	77·86	88·46
,, Constabulary Station	3·23	10·31	8·99	83·52	75·76
Point Galera—Light House	2·02	9·93	7·18	68·85	53·66
Tobago.					
Tobago—Hermitage estate	7·89	6·98	8·00	91·86	103·82
,, Riversdale ,, ...	4·35	5·59	6·38	74·80	83·12
,, King's Bay ,, ...	5·21	7·35	7·32	87·57	95·04
,, Roxburgh	8·55	7·56	7·30	89·22	109·23
,, Lure estate	3·14	8·66	3·44	75·20	99·86
,, Botanic Station	5·42	4·78	5·51	67·80	76·30
,, Government Farm	2·97	3·33	2·51	47·15	57·83
,, Lowlands estate	1·74	6·24	..	...	70·73
,, Friendship estate	2·03	...	..	.	65·13
,, Bon Accord estate	2·38	...	...	...	56·67

(*Bulletin, Department Agriculture, Trinidad & Tobago*, pp. 171–248. Issued Feb. 15, '18).

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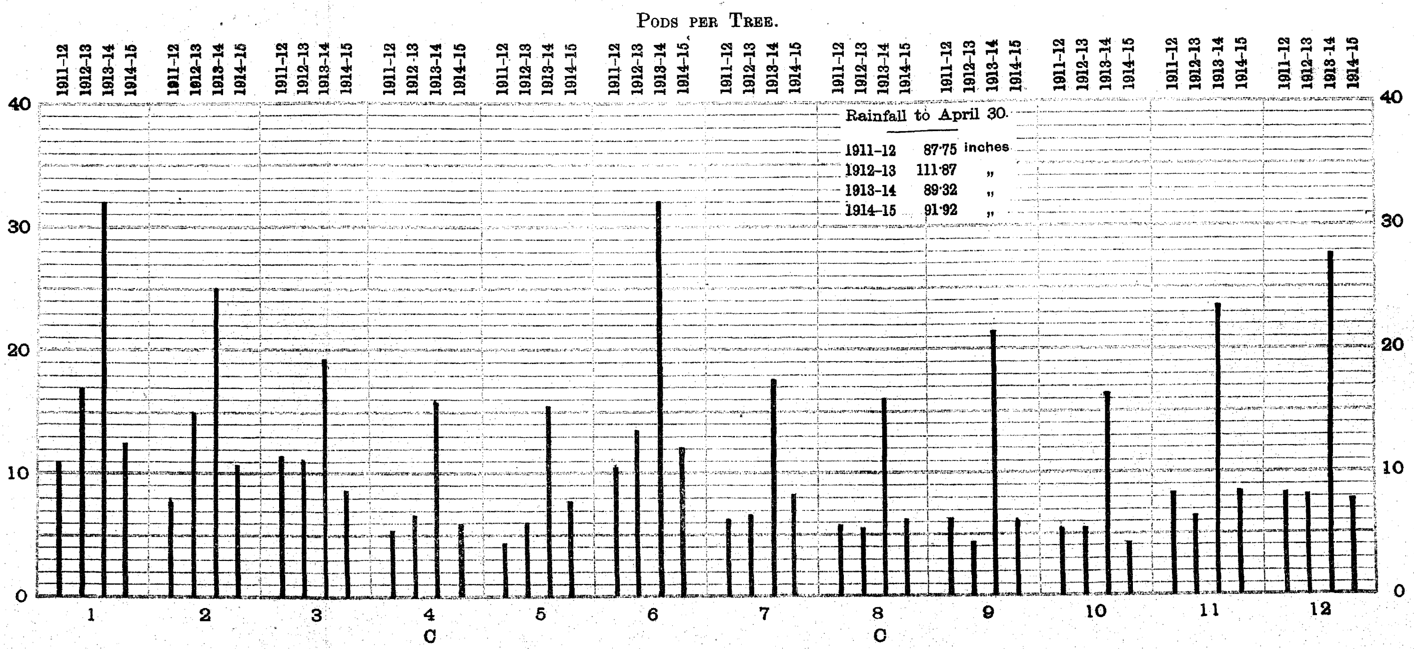
Diagram I.—Comparative yield of plots for four years on Santa Marta Estate.

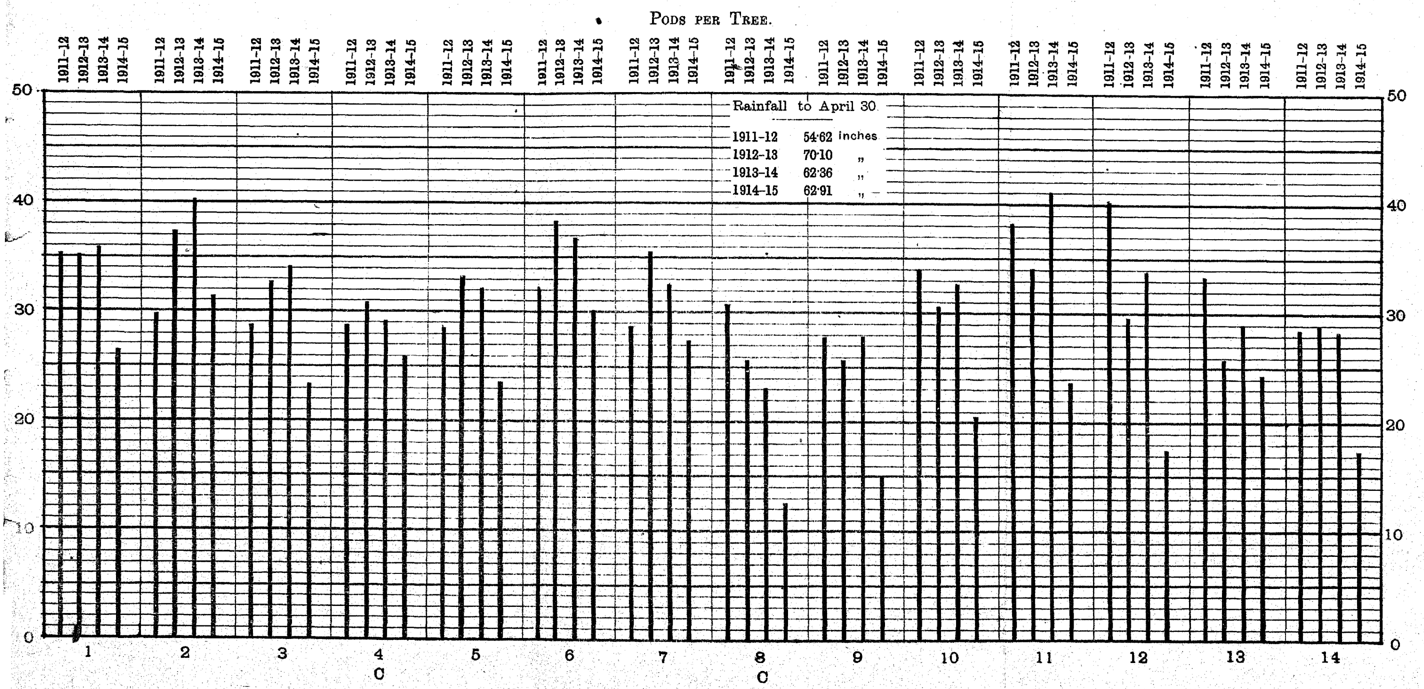


Rainfall to April 30.

1911-12	87·75	inches
1912-13	111·87	„
1913-14	89·32	„
1914-15	91·92	„

Explanation.—The plots are indicated by the numbers 1, 2, 3, 4, etc. C means control or *no manure* plots. Each distance from 0 to 10, 10 to 20, etc., represents ten (10) pods per tree and therefore the distance from any one horizontal line to the next is equivalent to one (1) pod per tree. The average number of pods picked per tree from each plot for each of the four years, has been plotted to scale and is therefore shown by the length of the vertical black lines.

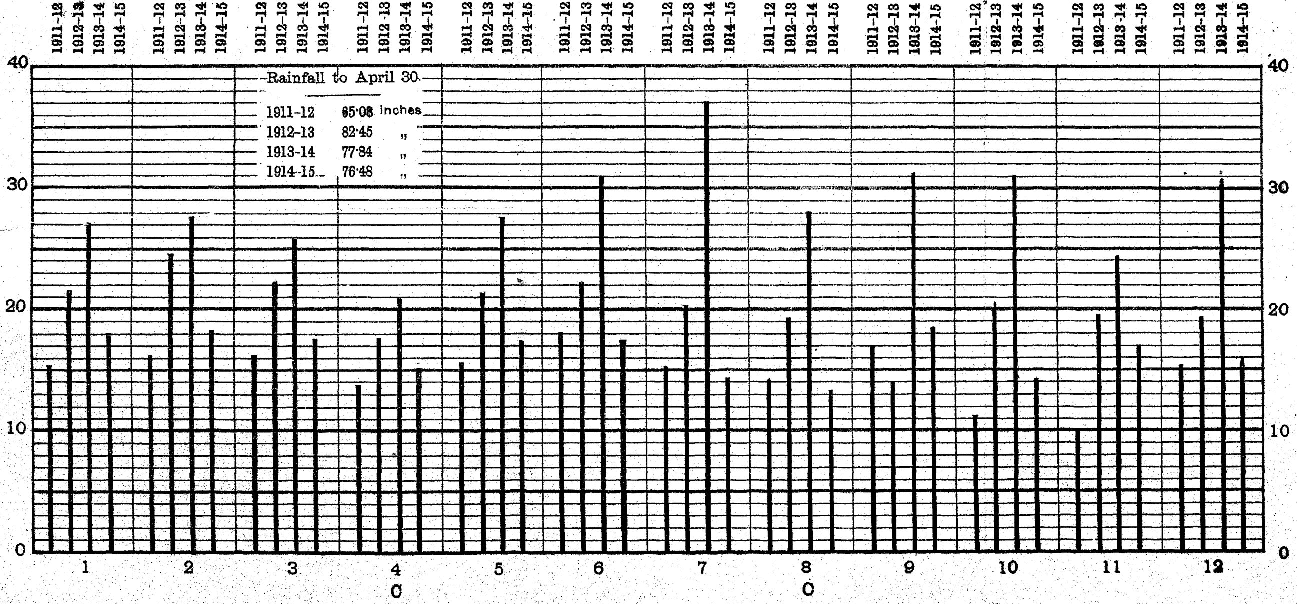
Diagram VIII.—Comparative yield of plots for four years on Soconusco Estate.



Explanation.—*Vide* foot-note Diagram I.

Diagram VI.—Comparative yield of plots for four years on La Compensacion Estate.

Pods per Tree.

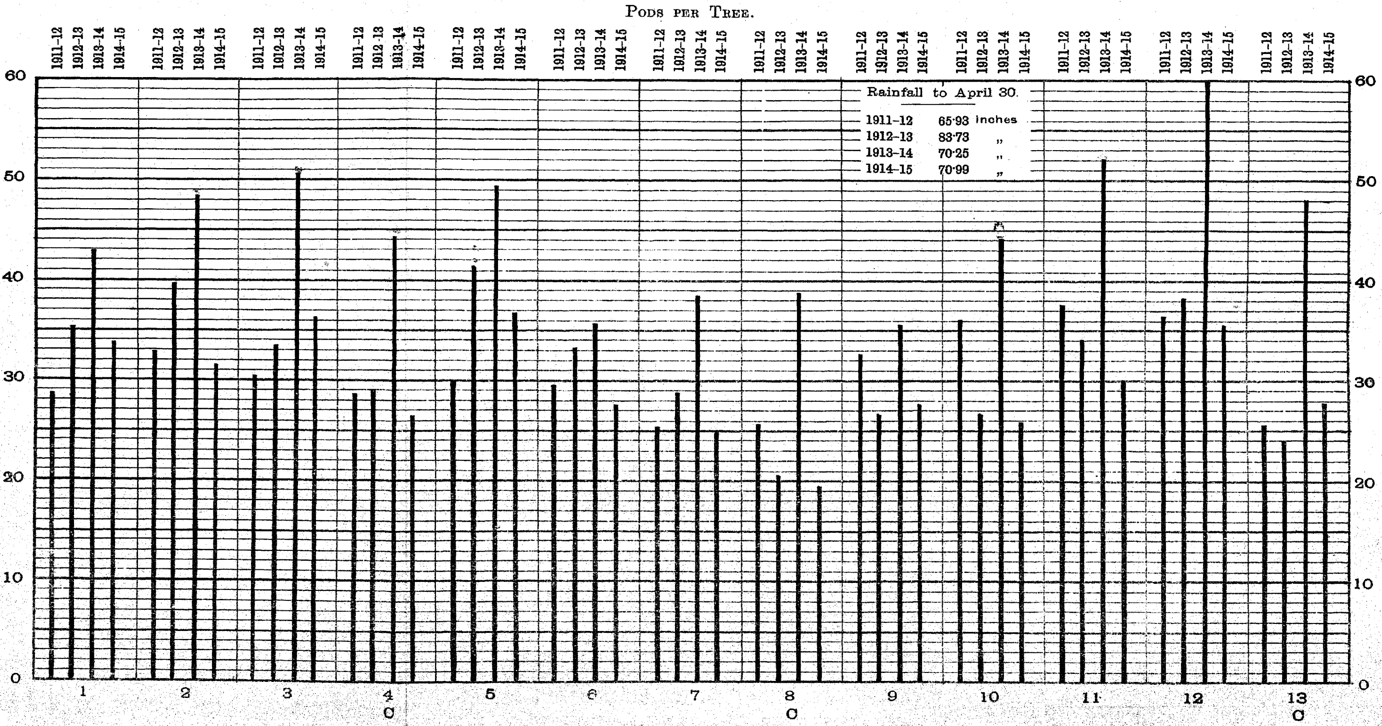


Rainfall to April 30.

1911-12	65·08 inches
1912-13	82·45 ,,
1913-14	77·84 ,,
1914-15	76·48 ,,

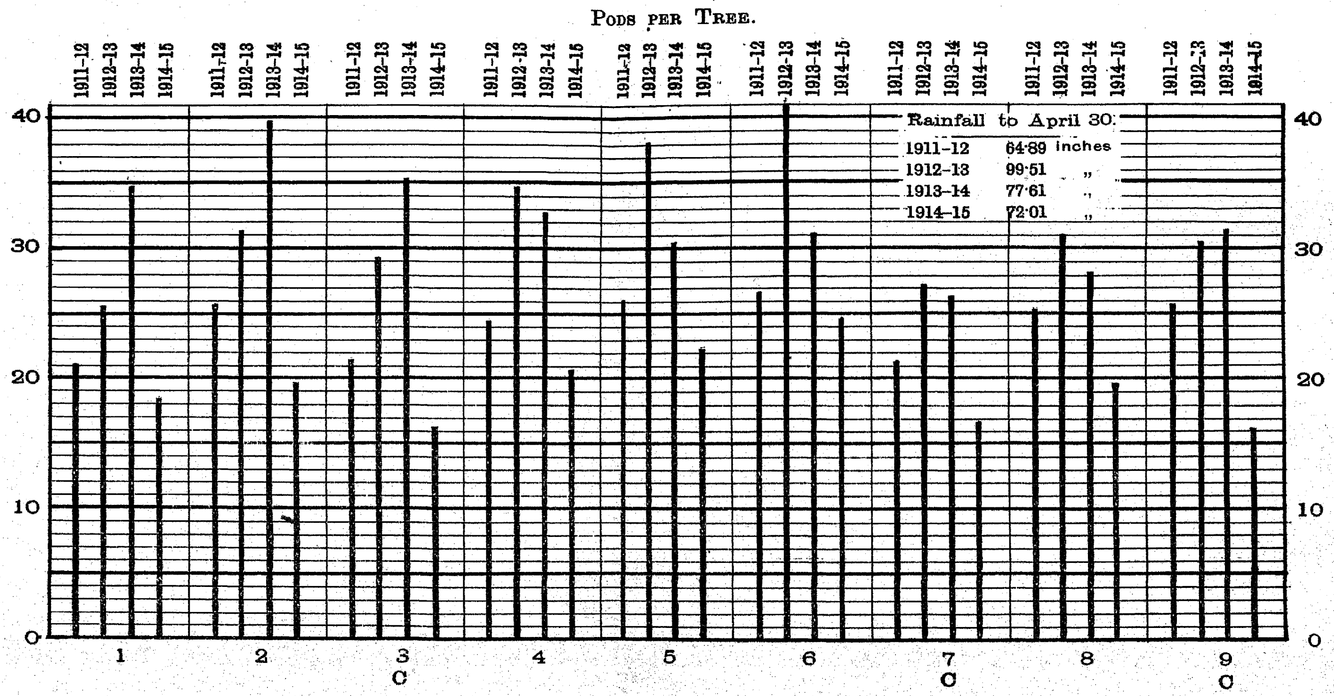
Explanation.—*Vide* foot-note Diagram I.

Diagram VII.—Comparative yield of plots for four years on Santa Isabella Estate.



Explanation.—*Vide* foot-note Diagram I.

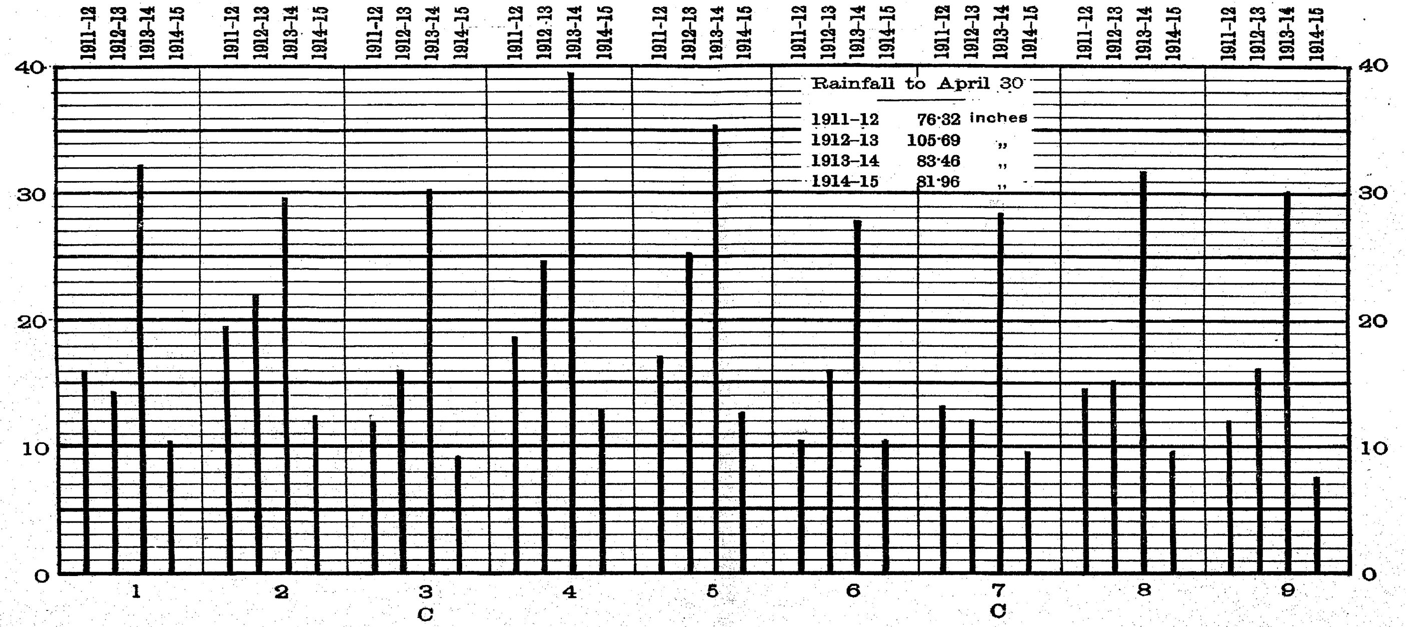
Diagram V.—Comparative yield of plots for four years on Perseverance Estate.



EXPLANATION.—*Vide* foot-note Diagram I.

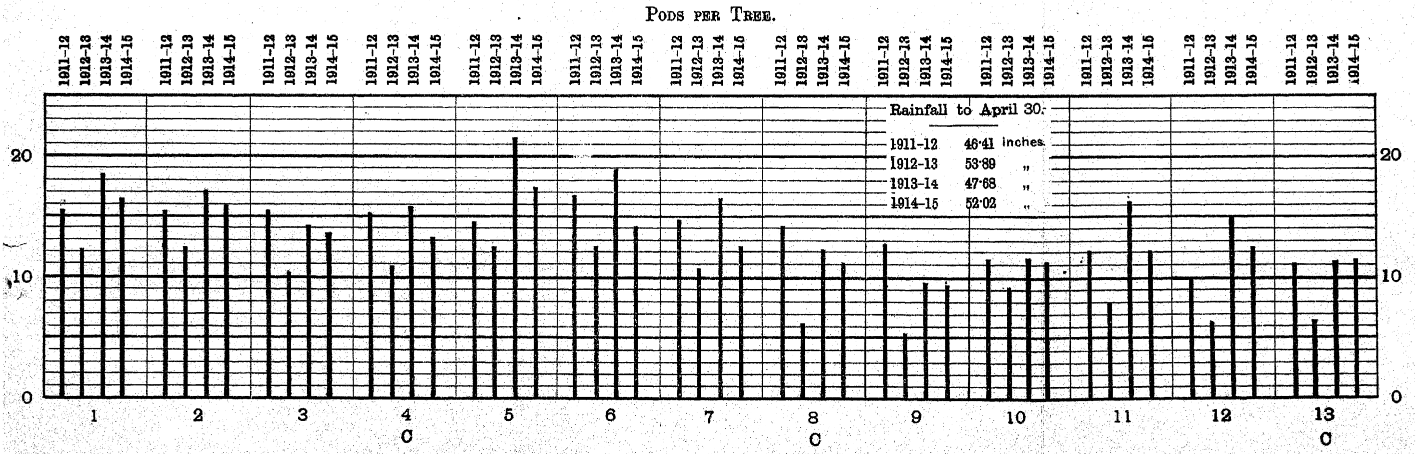
Diagram IV.—Comparative yield of plots for four years on Santa Teresa Estate.

Pods per Tree.



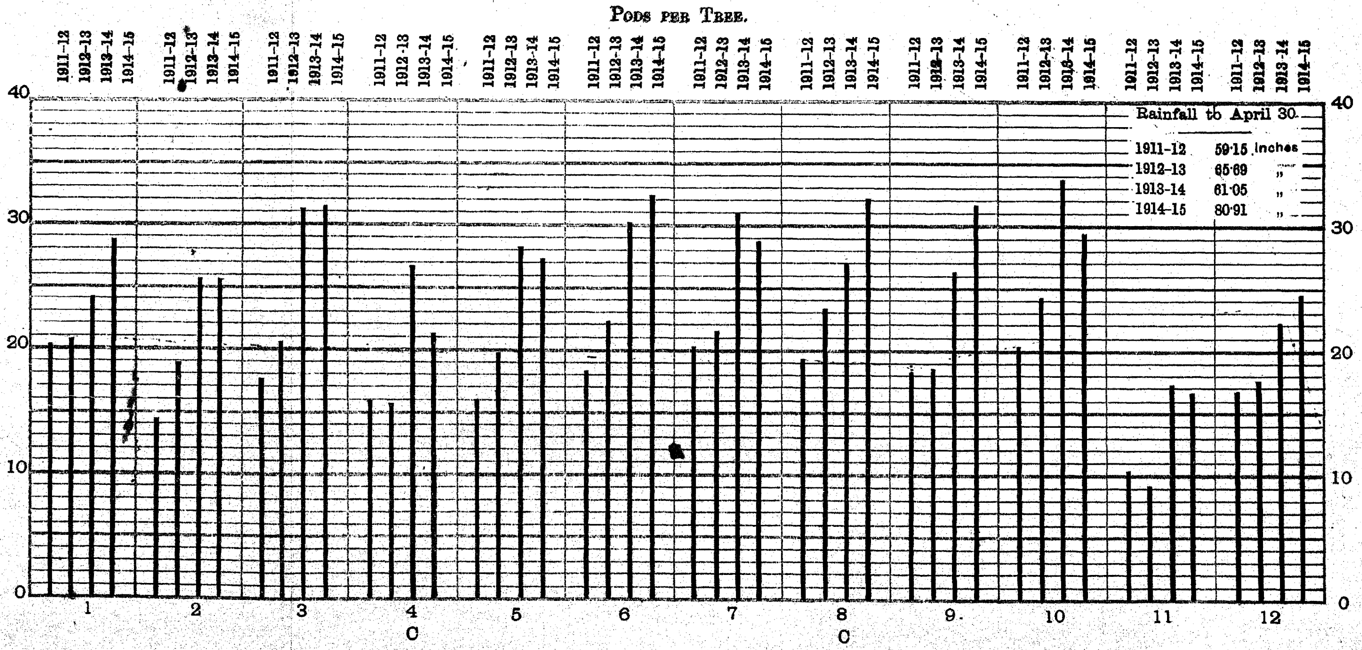
Explanation.—*Vide* foot-note Diagram I.

Diagram II.—Comparative yield of plots for four years on Esperanza Estate.



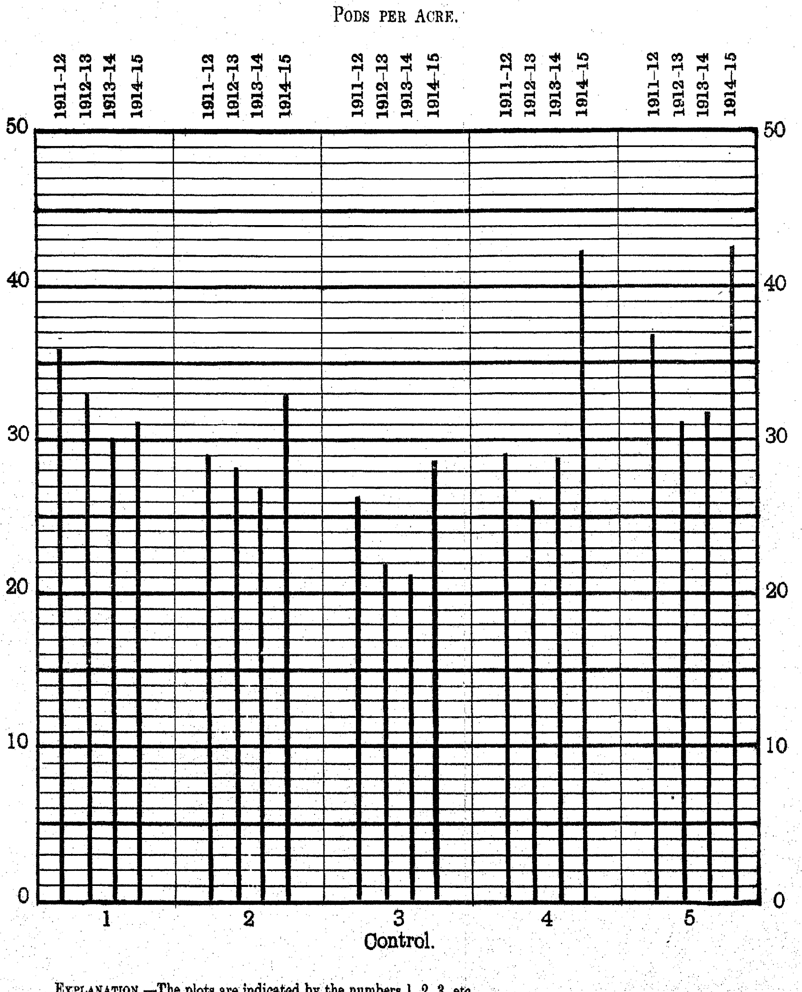
Explanation.—*Vide* foot-note Diagram I.

Diagram III.—Comparative yield of plots for four years on New Grant Estate.



Explanation.—*Vide* foot-note Diagram I.

Diagram VIII.—Comparative yield of plots for four years on Richmond Estate.

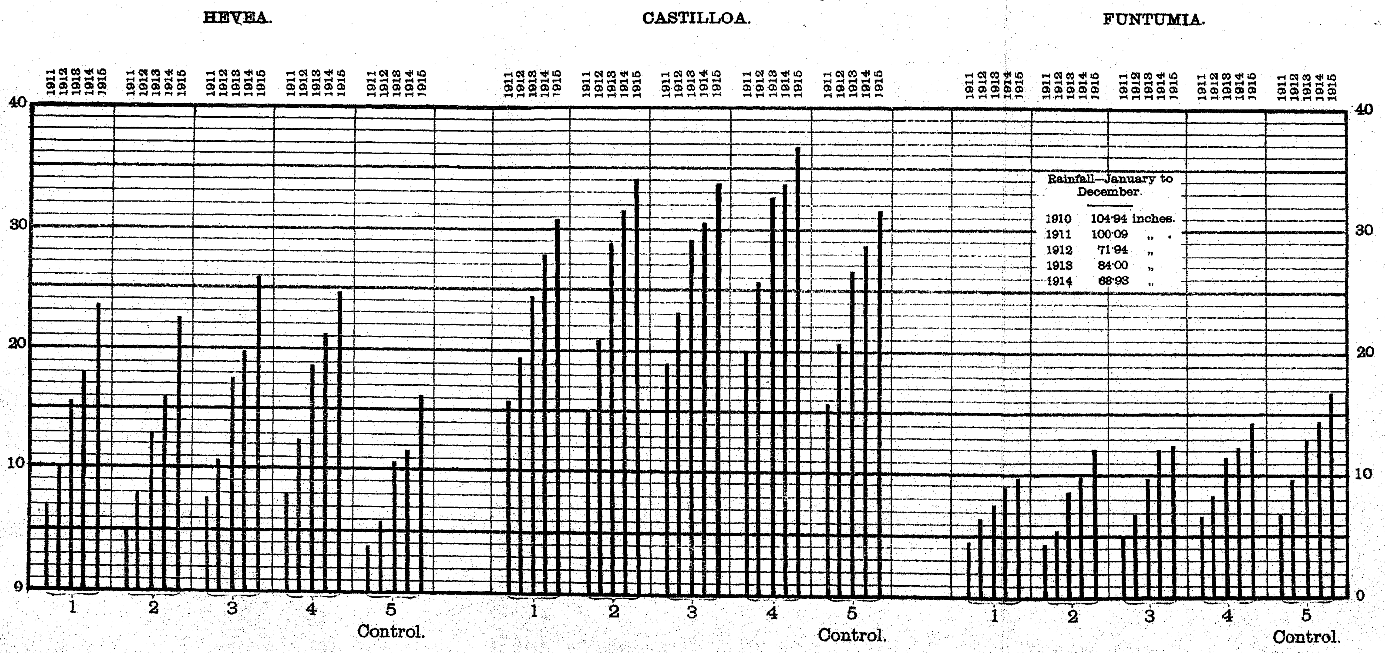


Explanation.—The plots are indicated by the numbers 1, 2, 3, etc.

Each distance from 0 to 10, 10 to 20 represents ten (10) pods per tree and therefore the distance from any one horizontal line to the next is equivalent to one (1) pod per tree.

The average number of pods picked from each plot, for each of the four years, has been plotted to scale and is therefore shown by the length of the vertical black lines.

Diagram IX.—Comparative girth of Rubber Trees in inches for five years at Roxborough Estate—Tobago.

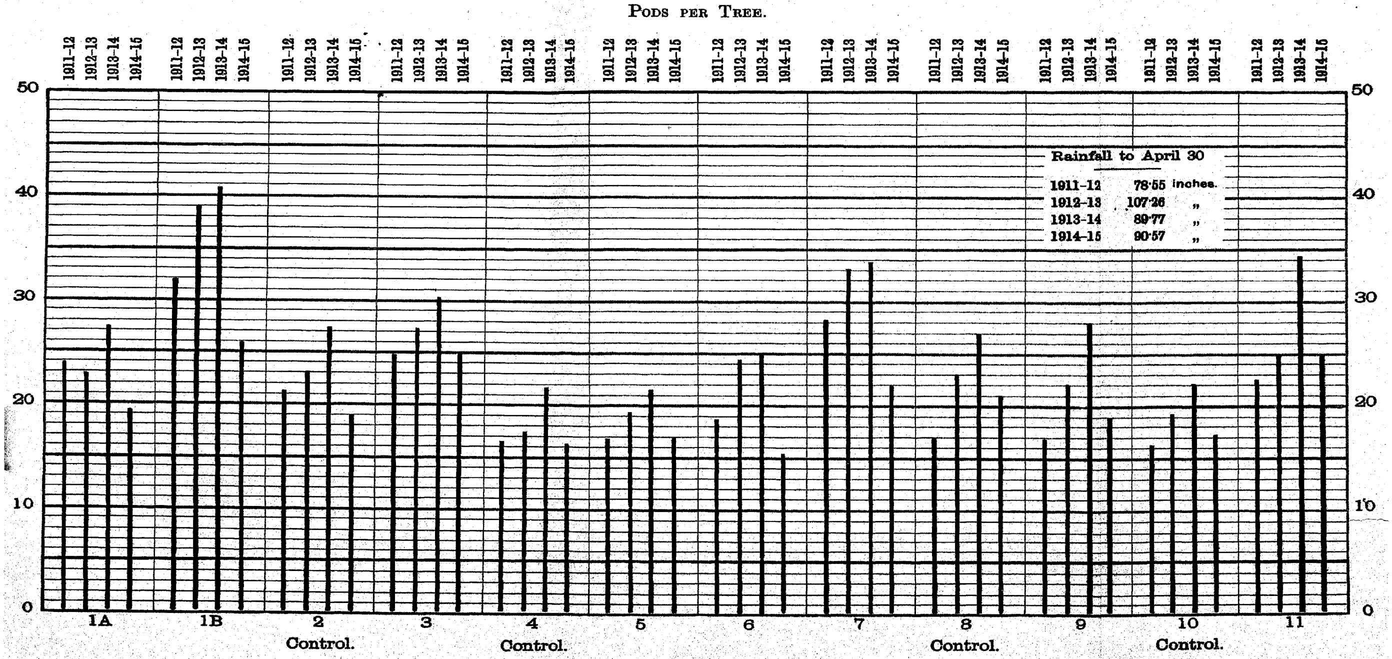


Rainfall—January to December.	
1910	104·94 inches.
1911	100·09 „
1912	71·94 „
1913	84·00 „
1914	68·93 „

EXPLANATION.—The plots are indicated by the numbers 1, 2, 3, etc.

Each distance from 0 to 10, 10 to 20, etc., represents ten (10) inches in girth and therefore the distance from any one horizontal line to the next is equivalent to one (1) inch.

Diagram VII.—Comparative yield of plots for four years on Brooklyn Estate.



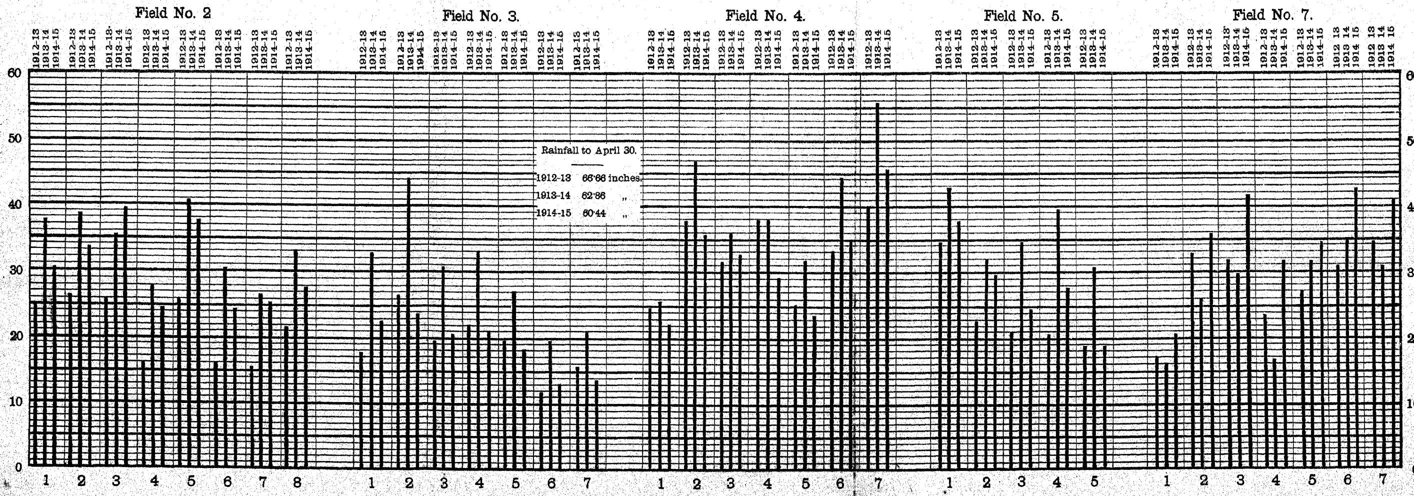
Explanation.—The plots are indicated by the numbers 1A, 1B, 2, 3, 4, etc. 2, 4, 8 and 10 are the control or *no manure* plots.

Each distance from 0 to 10, 10 to 20 represents ten (10) pods per tree and therefore the distance from any one horizontal line to the next is equivalent to one (1) pod per tree.

The average number of pods picked from each plot, for each of the four years, has been plotted to scale and is therefore shown by the length of the vertical black lines.

Diagram VI.—Comparative yield of Natural yield plots for three years in Fields 2, 3, 4, 5 and 7.

Pods per Tree.



Explanation.—The plots are indicated by the numbers 1, 2, 3, 4, etc., for each field.

Each distance from 0 to 10, 10 to 20 represents ten (10) pods per tree and therefore the distance from any one horizontal line to the next is equivalent to one (1) pod per tree.

The average number of pods picked from each plot for each field for the three years, has been plotted to scale and is therefore shown by the length of the vertical black lines.

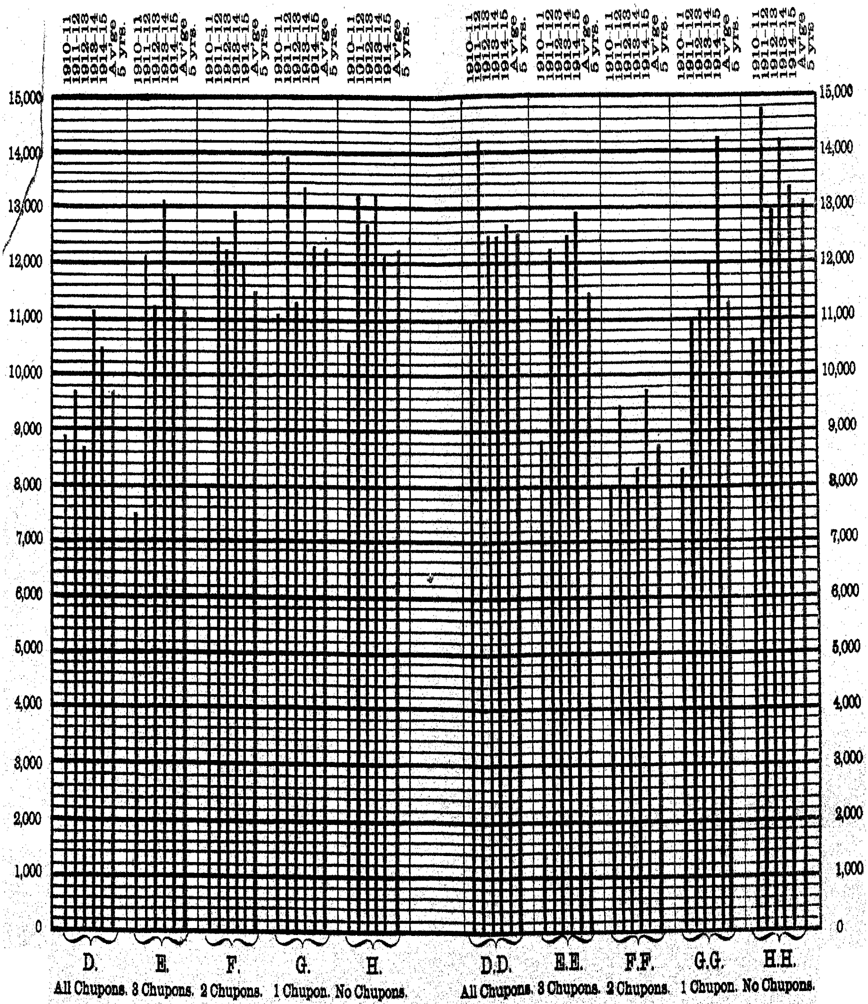
Diagram V.—Comparative yield of plots for five years in Chupon Experiments.

Trees 9 to 10 years old in 1910.
Planted 12 X 12

Trees 25 to 30 years old in 1910.
Planted 15 X 15

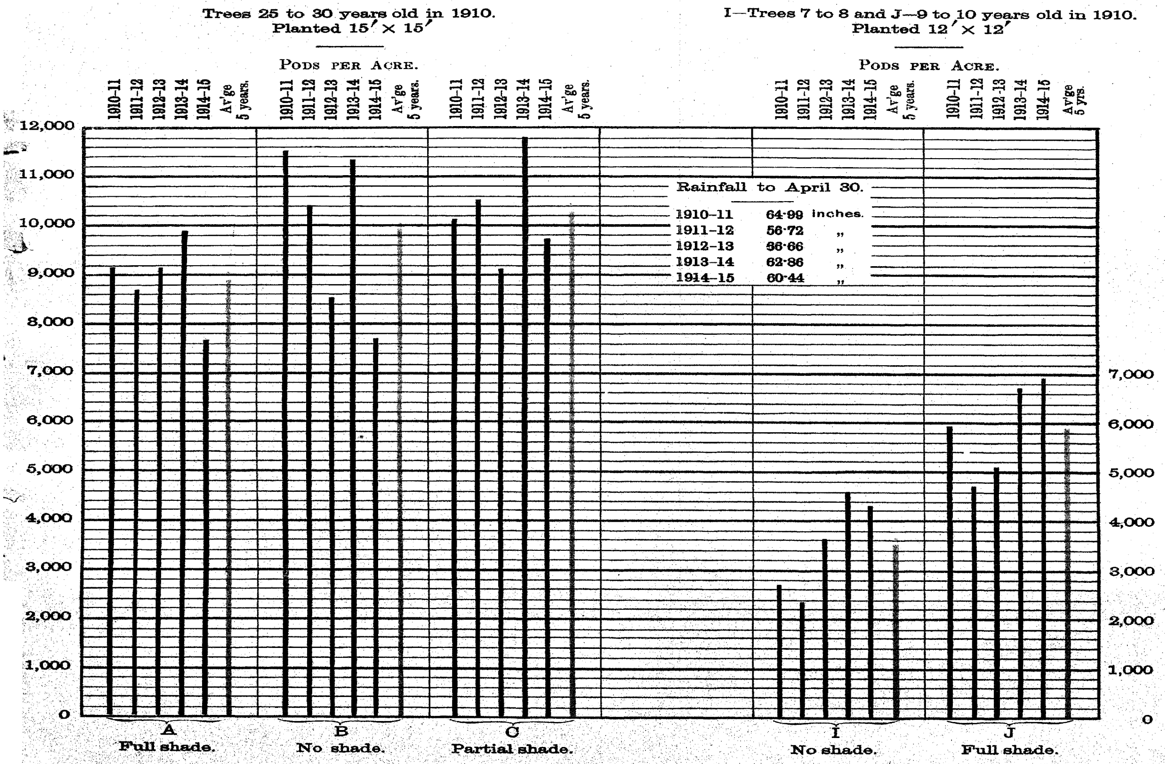
Pods per Acre.

Pods per Acre.



Explanation.—Each distance from 0 to 1,000, 1,000 to 2,000, etc., represents one thousand (1,000) pods per acre and therefore the distance from any one horizontal line to the next is equivalent to two hundred (200) pods per acre.

The number of pods picked per acre from each plot, for each of the five years, has been plotted to scale and is therefore shown by the length of the vertical black lines.



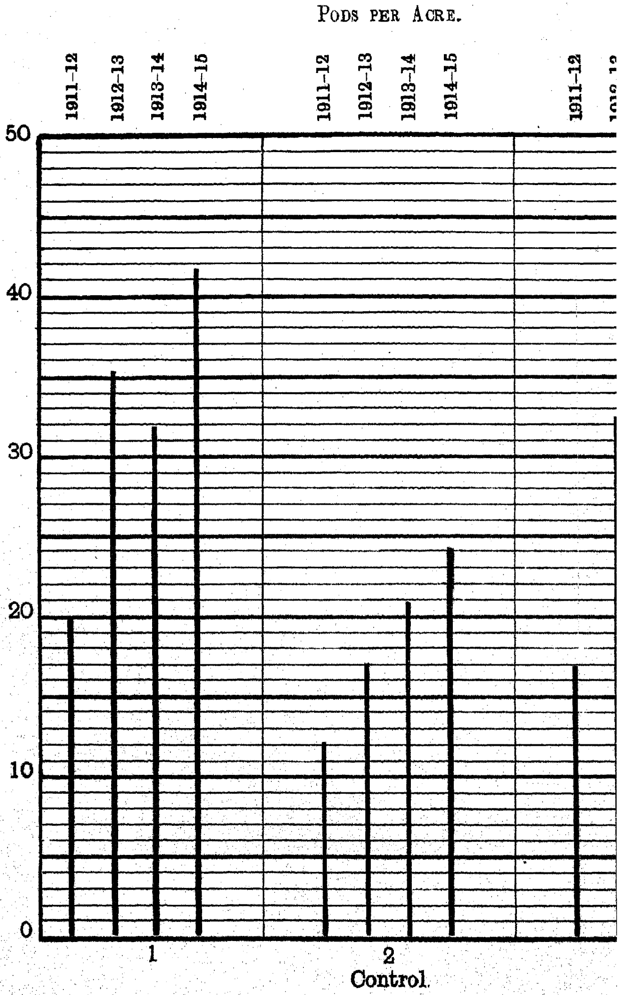
Trees 25 to 30 years old in 1910.
Planted 15′ × 15′

I—Trees 7 to 8 and J—9 to 10 years old in 1910.
Planted 12′ × 12′

Rainfall to April 30.	
1910–11	64·99 inches.
1911–12	56·72 ,,
1912–13	56·66 ,,
1913–14	62·86 ,,
1914–15	60·44 ,,

Explanation.—Each distance from 0 to 1,000, 1,000 to 2,000, etc., represents one thousand (1,000) pods per acre and therefore the distance from any one horizontal line to the next is equivalent to two hundred (200) pods per acre.

Diagram III.—Comparative yield of Ohlendorff's plot

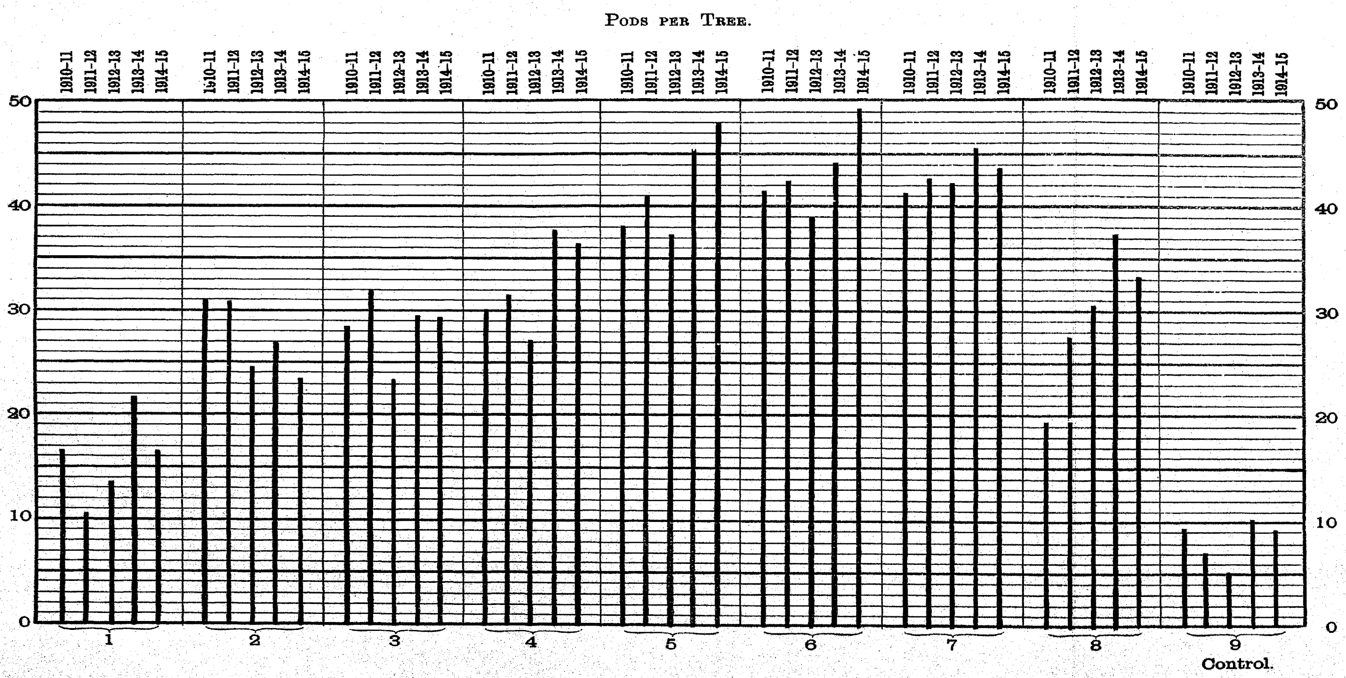


EXPLANATION.—The plots are indicated by the numbers 1, 2 and 3.

Each distance from 0 to 10, 10 to 20, etc., represents ten (10) pods per tree an
from any one horizontal line to the next is equivalent to one (1) pod per tree.

The average number of pods picked per tree from each plot for each of the four ye
scale and is therefore shown by the length of the vertical black lines.

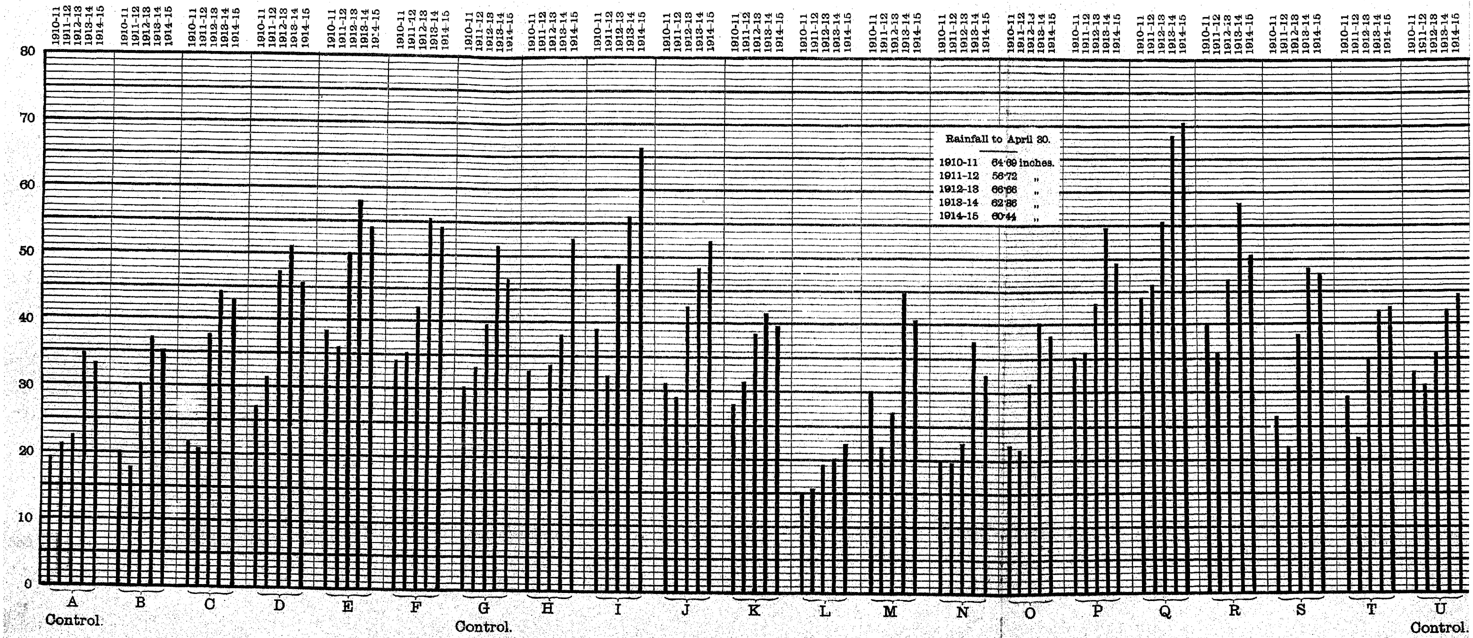
Diagram II.—Comparative yield of plots for five years from Field No. 6 at River Estate.



Explanation.—The plots are indicated by the numbers 1, 2, 3, 4, etc. 9 is the control or *no manure* plot.
Each distance from 0 to 10, 10 to 20 represents ten (10) pods per tree and therefore the distance from any one horizontal line to the next is equivalent to one (1) pod per tree.
The average number of pods picked per tree from each plot, for each of the five years, has been plotted to scale and is therefore shown by the length of the vertical black lines.

Diagram I.—Comparative yield of plots for five years from Field 1 at River Estate.

Pods per Tree.



Rainfall to April 30.

1910-11	64·69	inches.
1911-12	56·72	„
1912-13	66·66	„
1913-14	62·86	„
1914-15	60·44	„

Explanation.—The plots are indicated by the letters A, B, C, D, etc. A, G and U, are the control or *no manure* plots.

Each distance from 0 to 10, 10 to 20, etc., represents ten (10) pods per tree and therefore the distance from any one horizontal line to the next is equivalent to one (1) pod per tree.

The average number of pods picked from each plot for each of the five years, has been plotted to scale and is therefore shown by the length of the vertical black lines.